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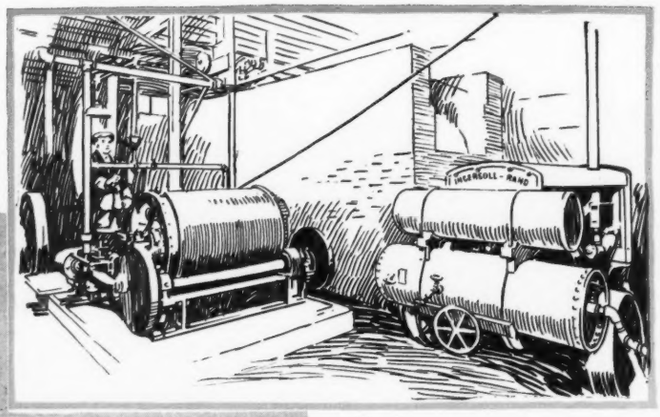
American Dredges in the Urals
By John B. Bubb

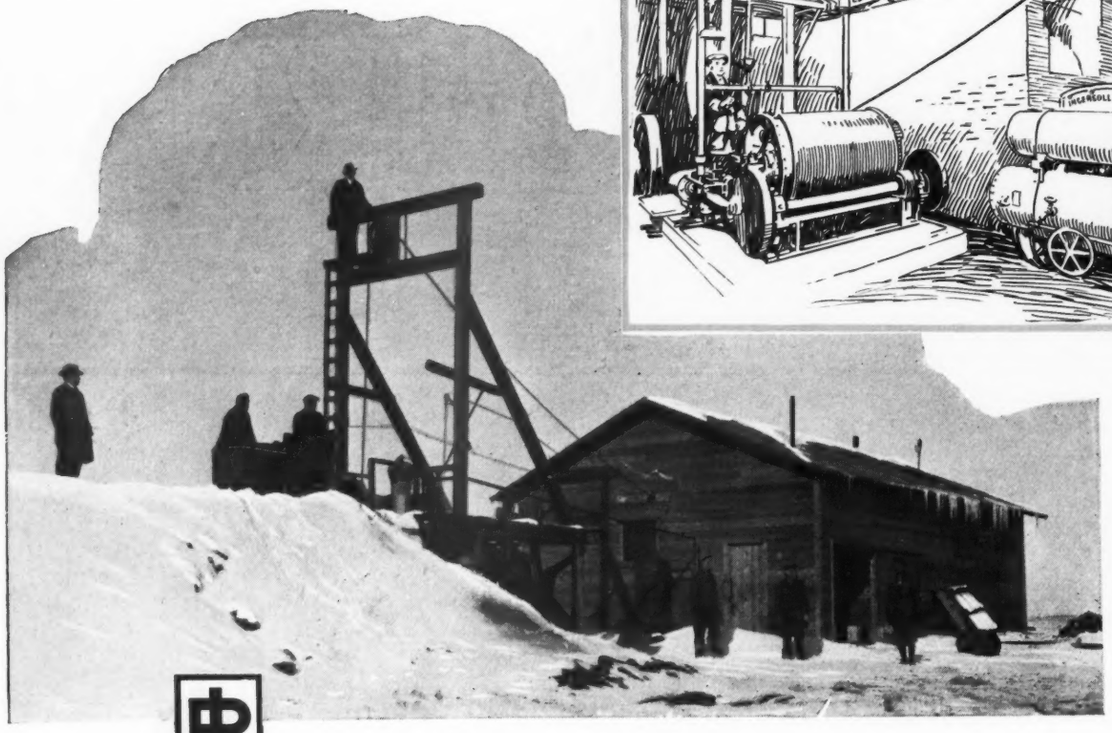
Geology of the Wood River District, Idaho
By Stewart Campbell

The Morenci Concentrator of Phelps Dodge
By E. H. Robie

Lime Plant of Chief Consolidated
By H. D. Keiser

Mining Ore at Broken Hill
By E. J. Horwood





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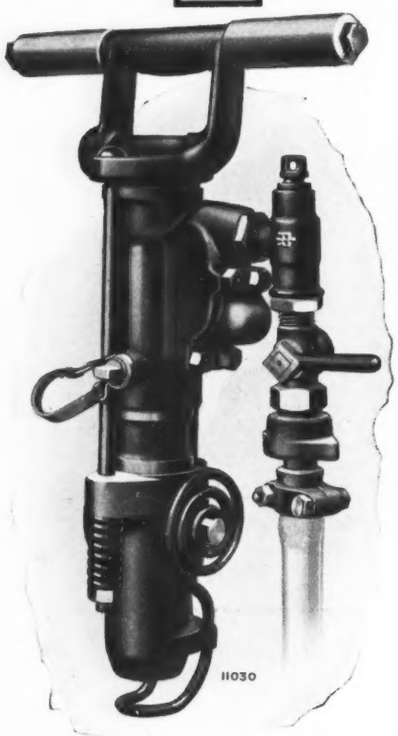

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Blowing In the Noranda Smelter

AMONG spectacular mining developments in recent years, the Noranda enterprise ranks high in technical interest. In the first of a series of articles on this subject, to appear next week, Mr. A. H. Hubbell will describe the Horne mine ore deposits, in the Rouyn district of Quebec. In a subsequent article or articles he will describe the procedure and discuss the obstacles overcome in the consummation of the plans—the production of metal. One of the most interesting features of this series will be the reproduction of the smelter log book kept during the blowing in—covering a 36-day period from the lighting of wood fires in the reverberatories to the pouring of copper on a normal operating basis. Full details of current metallurgical practice will also be given.

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ENGINEERING AND
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McGraw-Hill Publishing Company, Inc.
JAMES H. MCGRAW, President

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VOLUME 126 — New York, August 25, 1928 — NUMBER 8

Laws That Hamper Economic Evolution Should Be Modified

SPEAKING before the Mineral Section of the American Bar Association at Seattle, Wash., recently, Mr. Cornelius F. Kelley, president of the Anaconda Copper Mining Company, after summarizing the commercial and economic development of the United States in recent decades, visioned the absurdity in the retention of a marine regulation prescribing a directing mechanism adapted to conditions obtaining fifty years ago, and which hide-bound tradition and unthinking prejudice refused to alter to meet existing conditions. "The Sherman law," he reminded his hearers, "was passed thirty-eight years ago, a span that exceeds the active business life of most men who today are conducting the enterprises of the United States." And, he inquires, pertinently, "How many business organizations are run today upon the basis that existed a generation ago?"

As this publication has persistently maintained, the time is overdue for an investigation that should ignore the slogans invented to distort the vision of those seeking the truth. An inquiry only is asked, as a preliminary. The outcome of an official examination of conditions in the petroleum and coal industries is well known, and *Engineering and Mining Journal* is in agreement with Mr. Kelley when he says:

"Does not the fact that the two most elaborate and exhaustive fact-finding commissions, acting under the sanction of two different presidents of the United States, to inquire into conditions of two of the principal mineral industries of the country, disclose a condition that calls for modification of our anti-trust legislation, demonstrate the absolute necessity for so doing?

"Should a similar investigation be made into the production of iron ore, copper, lead, and zinc, there is no doubt but that a comparative condition of overdevelopment, overproduction and waste, compelled by the endeavor to meet competitive market conditions, would be disclosed.

"For nearly forty years we have followed the firmly established policy of promoting competition and securing the cheapest price possible to the consuming public. So insistent has been our governmental attitude in this respect that it has almost become a fetishism, and yet yielding to the insistent demands of powerful groups certain classes who would most loudly maintain that the doctrine be held to apply to others have succeeded in being themselves excluded from its operation. Has not the time come when the mineral industries of the country should present their special case before the bar of public opinion and ask for the relief which is not alone urgently needed for the continued prosperity of the units engaged in it, but which is demanded in the public interest as well?

"It is comparatively easy to point out the defects in our present system. Between divergent views lies a wide range of philosophic thought and political faith. There is a field for constructive statesmanship in industry as well as politics, and the industrialist who has but a single eye directed toward his balance sheet is thinking in terms no broader than the demagogue whose concept of public duty is to direct his efforts to catch the whimsical echo of a temporary popular approval. To bring about the closer relationship of industry to government, which after all is but the administration of the affairs of the people, to seek to dispel the illusion that the interests of government, representing the collective will of the people, and industry can or should be regarded as inimical to one another, is the task to which we should apply ourselves."

Large Copper Consumer Commends Work of Copper Institute

FREQUENTLY the statement has been made in these columns that large consumers of raw materials such as lead, copper, and zinc would rather have a comparatively steady market for the commodity than one characterized by erratic and wide fluctuations, even though the average price under the former conditions should sometimes be a little higher. Some have been inclined to skepticism in this regard, intimating that the contention was special pleading in behalf of the metal-mining industry. Consequently, it is of particular significance to read the following remarks of Mr. E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, in an interview published in the monthly section of the *Daily Metal Reporter:*

"As a large consumer of copper, we are naturally interested in the recently organized Copper Institute. I believe that the copper interests are to be complimented on the remarkable progress they have made in stabilizing their industry. As the law of supply and demand governs prices to a great extent, I am not at all afraid that the Copper Institute or the Copper Exporters' organization will seek to boost prices artificially, for to do so would immediately result in greater competition and the probable substitution of other metals for copper."

Among the reasons why a reasonably steady price for his raw material is desired by the manufacturer, perhaps the most important is this: As competitive orders must be bid upon months in advance, it is highly advantageous to be able to count with some certainty on the approximate future price of those materials, the cost of which is an important element in the total cost of manufacture. This enables him to figure estimates more

closely, and to conduct his productive operations more efficiently. When the word "stabilizing" is used in connection with the influence that the Copper Institute has had on the price of copper, it is not synonymous with "increasing." For example, last June a buying wave and "near-squeeze" for prompt metal developed. It is entirely probable that the price would have passed 15c. instead of remaining at 14.75c. had it not been for the restraining influence of the statistical activities of the Copper Institute. The attitude of Mr. Herr is that of most other broad-gage executives who are able and anxious to see farther into the future than the current month.

Underground Mining in City Construction

CYNICISM, and perhaps disappointment, prompted the definition of a mine as a hole in the ground owned by a liar. Curiously enough, despite the frequent evidence of corruption in city politics, no one has associated the holes made in the ground and leading to and under a modern city with mendacity. In the current issue of "The American Magazine" Mr. Richard Kent submits an amazing array of figures that illustrate the immensity and complexity of the subterranean construction completed and pending in and around the island of Manhattan. Open-cut excavation, the sinking of shafts, the driving of tunnels, the use of explosives, provision for adequate ventilation —these are all within the field of mining engineering; yet one finishes the article with the impression that no member of the mining industry has participated in this work.

A cramped municipality must of necessity go underground to provide conduits for traffic, for mail transport, power, artificial light and heat, and telephone and telegraphic communication. Two hundred million dollars was the cost of the Catskill Aqueduct—to bring water to New York City. And, quotes Mr. Kent, "At its lower end, for a distance of fifteen miles or more, at a depth of from thirty to eighty feet, this aqueduct will pass under the city—under Central Park, down Broadway and Sixth Avenue, under Fifth Avenue at Madison Square, under the East River at Delancey Street to Brooklyn; then under the harbor to Staten Island!" This record of construction in itself is a gigantic mining enterprise.

More and more is passenger traffic in the city being deflected from the streets. New York possesses nearly two hundred miles of underground railroad tunnels and nearly 800 miles of track. In parts this is so far from the surface that elevator shafts are necessary to connect train platforms with the street sidewalks above. Vehicular traffic into and out of a congested region such as Manhattan Island is being facilitated by tunnel approaches. Witness, for instance, the Holland Tunnel connecting New York and New Jersey, recently completed at a cost of about $50,000,000. In essentials of design and construction it was a mining engineering job. Perhaps the average mining engineer could learn something from the elaborate system of forced-draft ventilation that keeps the atmosphere in the tunnel free from a dangerous proportion of poisonous fumes—the result of an exhaustive research conducted by engineers on the staff of the U. S. Bureau of Mines at Pittsburgh.

Underground mining in a city serves purposes other than for traffic and water supply. Pneumatic transport of mail appreciably diminishes congestion in the streets above. The New York system of tubes is 54 miles long, connecting various main post offices and stations and handling 70 tons of mail per day. Gas main and sewer conduits are also to be found in the labyrinths of the city's arterial system, but complexity reaches the apparent limit in telephone wires. One special task that confronted a New York telephone company is quoted by Mr. Kent: A subway line proved a serious obstruction. "So two shafts were sunk on either side of Seventh Avenue, down to bedrock, twenty-five feet below the tracks of the subway, fifty feet under the surface of the street. Sappers—with picks, shovels, and dynamite—worked beneath the subway trains laden with passengers, and eventually cleared a U-shaped passage, 150 feet long, eight feet wide and eight feet high. More than a third of a million separate telephone wires now lie in the tunnel."

Increased power demands, improved living conditions, the need for the artificial adjustment of atmospheric conditions in the larger buildings—these and many other factors are making it necessary to precede building construction with extensive excavation work. An immense open cut is being completed near the publication offices of the McGraw-Hill organization, the work being accompanied by all the familiar practices and paraphernalia of modern mining. It extends to 75 feet below the sidewalk; and five floors of space will be provided for the varied supply and service requirements of a large modern hotel.

The story of opportunity and achievement in the laying out of a modern city, or bringing an old one up to date, is a fascinating one, but no feature is more important than the provision of means for underground transport and communication. In this field the mining engineer should distinguish himself. He and the associations which represent him should "get into the picture." He is familiar with the problems involved and is capable of solving them. His breadth of experience should point the way to speedy performance, accurate result, and minimum construction expense.

Effect of Excessive Grinding Prior to Wet Chemical Treatment

A QUERY was recently made as to how fine a gold ore should be ground to insure maximum recovery by cyanidation. The question was unanswerable without ample data, but these were not forthcoming. The impression was held that the highest recovery inevitably followed comminution to the ultimate limit, and it was difficult to undermine this deep-seated conviction. A point invariably overlooked is that excessive fine grinding results in the intensification of surface-tension influences, which unquestionably exert a powerful effect on the solution with which the ore particles are surrounded. The area of solid thus exposed is too vast to permit of computation. Complex and intense inter-phase reactions between solid and liquid are inevitable, and it is probable that many an unfavorable result in the cyanidation of a simple gold ore that has been finely ground may be attributed to this action.

To quote from an article published ten years ago:

"Absorption of metal by colloid particles plays an important part in the all-sliming process and may be cited as one reason at least for the non-recovery of all the extracted metal. It is no longer possible, in the light of contemporary investigations, to speak definitely of dissolved or undissolved gold after cyanide treatment, when it is impossible to determine how much of the metal has been dissolved and absorbed, and how much has been untouched by the solvent. Absorption and adsorption are phenomena that are largely influenced by the question of fineness of division; and this fact may serve to explain the reason for the comparatively high residual content after milling and fine grinding in a cyanide solution carrying valuable metal, or in which a proportion of the metal is immediately dissolved."

The article in question also dealt with the opportunities offering for greater economies and the reduction of such hazards in the treatment of a gold ore. Recent developments and tendencies suggest that other parts of the article are worth repetition. An example was quoted of research at a property where previous milling operations showed that 86 per cent of the gold could be concentrated in about 7 per cent of the tonnage. Tests on the 93 per cent remaining, constituting the tailing after amalgamation and concentration, showed that this could be reduced to 45 cents per ton by crude cyanide methods, and apparently without further grinding expense. To a metallurgical onlooker, these results seemed to indicate in outline how a successful scheme of treatment might be formulated.

The 45-cent residue, however, was considered discouraging! And further experiments on a sand of normal fineness for leaching purposes were apparently not considered. Tests were made to see how much gold could be dissolved by an experimental agitation treatment. The results indicated that all was soluble, provided grinding was carried far enough. Laboratory extractions of 99.7 per cent were obtained with clean solutions; and as a result it was decided to grind and re-grind the 7 per cent of the concentratable material without separation from the 93 per cent of low-grade ore, so that every particle of worthless rock and absorbent colloid should be thoroughly steeped in as rich a solution of gold as possible!

History has shown that results are not always as one would wish or as might be expected by those who disregard the complexity of a working cyanide solution and the adsorptive nature of any finely ground material. When all up-to-date refinements have been adopted, and residues are still high after such treatment, it is not uncommon practice to follow countercurrent decantation by filtration; and if the residues are still high, to re-pulp and refilter, and then to seek additional means of treating the tailing in an attempt to reduce gold content.

The application of remedial measures at the tailing end of the plant is seldom completely successful, especially when the trouble is due to a cause that demands something more than a repetition of normal treatment. Physico-chemical advance ten years ago showed that the decomposition of an unstable solution and the removal of a constituent may be insured by bringing it in contact with a solid that had been subdivided to present an immense surface area. The greater the subdivision, the greater the surface action.

In every phase of cyanidation the hazard of residue loss may be minimized by limiting excessive comminution to a concentrated product or to a middling that has been impoverished of as much gold as possible. The practice of steeping finely divided but worthless gangue material in a rich solution of gold is almost certain to lead to an otherwise avoidable residue loss.

Miners' Phthisis Compensation May Be Reduced in Africa

ONE MILLION POUNDS STERLING —more than 2 per cent of the value of total production and more than 10 per cent of dividends declared—was the toll paid last year by Rand mining companies to meet the ever-increasing requirements for compensation under the South African miners' phthisis acts. That the unwitting victims of the disease should be aided is only just. But this justice to them is not enough. It is to the credit of the industry that official and industrial action has been taken to provide for the workers every protection that science and humanitarian considerations can devise.

If the United States had not attempted to check malaria and yellow fever in Panama, but had merely been content to pay benefits to their victims, the Canal might eventually have been completed. But the cost—in time, money, and lives—would have been tremendous. The world at large has learned by now the lesson of the superiority of prevention to cure. Compensation to those already afflicted will not prevent future suffering. A study of the causes of miners' phthisis has led to an amelioration of at least its most devastating effects. Continued valuable research of this kind is fully justified, and the cost, compared with the present expenditure for injury, would be modest.

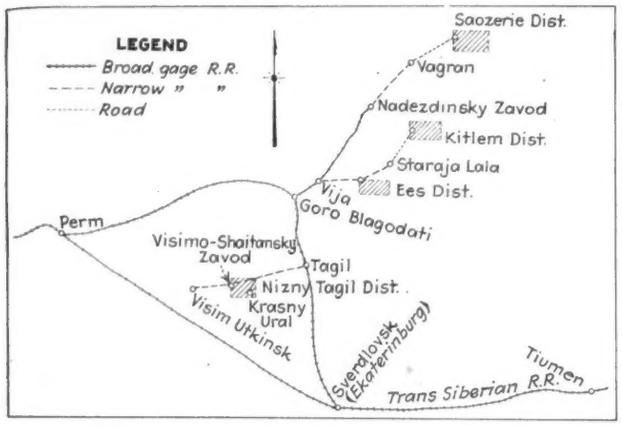
There are, however, other means by which the Rand companies might lessen the burden of compensation. At present about 200,000 native laborers are employed in the mines of the district. If this total were cut in half, the number afflicted by miners' phthisis should decrease in proportion. The pith of the matter lies in the ability of the mines to decrease the number of workers without adversely affecting output.

The value of the combined production of non-ferrous metals in Utah and Arizona is almost equal to that of the Rand. Yet in these two states there are probably not more than 50,000 men engaged in mining. Granting that the intelligence of the American worker is greater than that of the native "boy" on the Rand, and that the open-pit mines, which account for a large part of the total of the two states mentioned, require less labor to operate than the deep workings on the Rand, the difference is still so great as to call for some other explanation. The fact is that the machine has replaced the man wherever possible in the United States. In South Africa, however, the comparative low scale of native wages and the initial costliness of modern machinery have deflected attention from the eventual savings possible by the substitution of labor-saving apparatus. Now, with the native-labor problem becoming more and more difficult as a result of the stand of the authorities in Portuguese East Africa in limiting the labor supply, and with compensation payments for miners' phthisis steadily mounting year by year, fresh consideration of the scope of mechanical equipment in reducing the number of laborers required would seem timely. Mechanization, not legislation, promises the ultimate in reducing to a minimum the hazard to health in the operation of the world's greatest gold field.

American Dredges Now Operating in the Urals

By JOHN B. BUBB
Berkeley, California

IN DECEMBER, 1924, the Union of Soviet Socialist Republics sent a commission to the Unites States to study placer dredges, in order that the Soviet government might profit by American dredging experience and, in turn, could apply the knowledge thus gained, together with American equipment, to the development of its platinum and gold placers. The commission, composed of five representatives of the trusts directly interested in the development of dredging in the U.S.S.R., spent about four and a half months in the United States, investigating various placers and their particular characteristics, and after making a thorough study of the different types of dredges, methods and costs of operation, and the dredge equipment and plants of the various dredge-manufacturing companies, decided upon the selection of 13½-cu.ft. bucket dredges for the Lower Tagil placers of Ural, and 7½-cu.ft. bucket dredges for the Kitlem district of Ural, as being best suited for the respective situations. The report of this commission, "Dredge Work in America," was published in Moscow after its return to the U.S.S.R.



Sketch map of the Nizny Tagil placers, Ural Platinum Trust

The Soviet government accepted the recommendations of its commission, and in April, 1925, placed an order through the Amtorg Trading Corporation, New York, with the Yuba Manufacturing Company, of San Francisco, for five electrically operated, all-steel "Yuba" dredges, four of these with 13½-cu.ft. buckets and one with a 7½-cu.ft. bucket. The equipment for the dredges, together with spare parts, was delivered at New York between Nov. 1, 1925, and the middle of February, 1926, and in turn was shipped direct to Leningrad on vessels chartered by the Soviet government. From Leningrad the equipment was shipped to the field over the Trans-Siberian Railroad, via Perm, to Tagil, where it was transferred from the broad-gage lines to a narrow-gage line running from Visim-Tagil to Utkinsk. A railroad extending from Ural station, on the latter railroad, was constructed through the mountains to the sites of two of the dredges, and two spurs were built from the line near Visim station to the dredge sites near the village of Visimo-Shaitansky Zavod. Approximately 18 miles of railroad had to be built in the Lower Tagil district before the equipment for the 13½-cu.ft. bucket dredges could be delivered to the respective dredge sites. Equipment for the 7½-cu.ft.-bucket dredge was shipped to Vija on the broad-gage railroad, transferred to the narrow-gage railroad to Staraja Lala, and then hauled from the latter station to the Kitlem district, a distance of approximately 46 miles.

The placers of the Ural Platinum Trust are divided into four districts, Nizny (Lower) Tagil, Kitlem, Ees, and Saozerie. Executive offices of the trust are at Sverdlovsk (formerly Ekaterinburgh) and are under the direction of a Soviet manager, the chairman of the Platinum Trust, and a technical director, with his staff of engineers. The Soviet manager reports to the Supreme Council in Moscow through the Sub-Supreme Council of Ural, and is responsible for all finances, materials, labor and welfare work. The technical director is responsible for all engineering work and the operation of the various mines and dredges and is under the direction of the Soviet manager. Likewise, each separate district has a local Soviet manager, a technical director, and an organization practically paralleling that of the main executive office. No executive can act independently, and all questions which arise must be passed upon in committee. Also, all recommendations, or actions, on new questions must be passed from the committee to the Sub-Supreme Council of Ural, or to the Supreme Council in Moscow, if necessary, to await the approval or rejection of the Soviet government.

The placers of the Nizny Tagil district, in which the 13½-cu.-ft. bucket dredges are operating, are about 105 miles northwest of Sverdlovsk and about 25 miles southwest of Tagil, the nearest town on the main line railroad. The placers are on the Martian, Shaitanka, and Visim rivers. The Martian flows to the south and to the west and into the Shaitanka. Visim River flows to the south and to the west, practically paralleling the Martian, and into the Utka, which is joined by the Shaitanka at the village of Visimo-Shaitansky Zavod. The Utka flows to the west and then to the south and joins the Kama, a tributary of the Volga. Ordinarily the Visim, Martian,

and Shaitanka rivers are small streams, but they often become torrents of considerable proportions during the rainy season, in July and August.

All of the ground along the Visim, Martian, and Shaitanka rivers, from where the Martian flows into it, has been worked by hand by the peasants for about 125 years. No workings are in evidence beyond a short distance where the Visim and Shaitanka join the Utka River or above the junction of the Martian and the Shaitanka rivers. All of the creeks between the Visim and the Martian rivers are still being worked by hand, as well as many of the higher benches which are outside of the dredging areas, as determined and posted by the Soviet government.

Power Plant at Tagil

Power is furnished for the dredges by a steam plant in Tagil, approximately 25 miles from the field. Gas from the blast furnace at the steel plant is utilized for fuel under the boilers. Two 5,000-kw. steam turbo-generators are used for making power. This, generated at 2,000 volts, is stepped up by a modern transformer station to 38,000 volts, and transmitted to the dredges over a high-tension line which makes a circuit of the dredging fields. Four transformer stations are placed at convenient points in the field and 4,400-volt feeder lines extend from these to the dredges, where the voltage is stepped down through transformers on the dredges to 440 volts.

A high-tension line from the main transformer station in Tagil to the field is carried on built-up steel poles, footed on concrete, within the city limits of Tagil, and thereafter on wooden poles and wooden structures. The lower end of the poles and the poles in the structures are usually about a foot above the ground and are bolted between pairs of old rails, which are imbedded in the ground. Crossarms on the poles are made of angles. The transmission line is well constructed and is amply protected by lightning arresters. Right-of-way for the line is cleared of all timber and brush and is free from fire hazard. Modern transformers, insulators, switches, and other equipment were supplied by the German General Electric International Company. The copper wire was manufactured in the U.S.S.R. Fireproof reinforced-concrete and brick transformer stations were built at all points along the line. The dredges, transformer stations and the power plant in Tagil are connected by a telephone system with the operating office in the village of Krasny Ural.

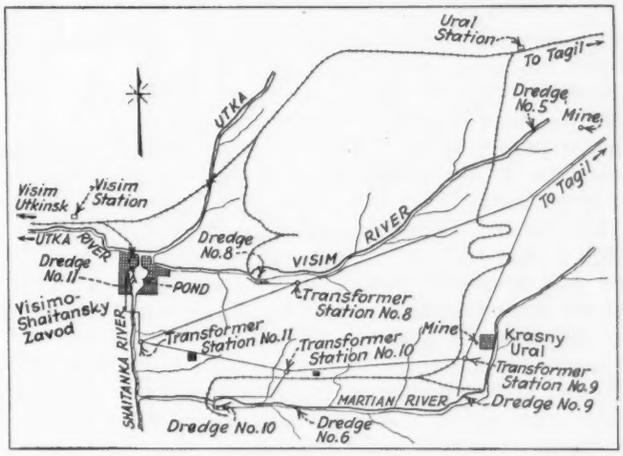
Preliminaries to Dredging

Ordinarily the Visim and Martian rivers are small streams, and to get enough water for starting the dredges it was necessary to build dams at the sites of No. 8 and No. 10 dredges and to rebuild an old dam at the site of No. 9. No. 11 was started in the pond at Visimo-Shaitansky Zavod, which formerly served as a source of water supply for a blast furnace and a small generating station.

Construction and maintenance of the dams add considerable expense to the cost of operating the dredges. All of the streams are filled with slimes and slickings from the hand workings which have been carried on for years. This material is not suitable for the dams, and material from the benches must be hauled in. Also, it is necessary to drive piling to prevent undercutting. The material for the dams is dug by hand, hauled an eighth to a quarter of a mile in ¼-yd. dump carts, each drawn by a single horse, and usually driven by women or boys, and is spread on the dump by hand. The piles are driven by a crude, portable driver, the tup being raised by a windlass operated by eight to ten workmen. It is no uncommon sight, during the construction of a dam, to see an endless string of dump carts working between the pits and the dam, and to see the pile-driving crew laboriously struggling with the piles and the cribbing. The Ural Platinum Trust hopes to install excavating machines, trucks, and mechanical pile drivers. Such equipment will greatly facilitate construction work and repairs and will relieve much of the anxiety during the flood stages now suffered by those in charge of operations.

Dredge Building Begun

The railroads to the dredge sites and the transmission line were completed by the Ural Platinum Trust in the spring of 1926 and the construction of the first dredge was started on June 1 of that year. The second dredge was started on Aug. 30, followed by the third on Sept. 29 and the fourth on Dec. 2. Early progress on the construction of the dredges was slow, owing to the lack of organized construction crews and the scarcity of construction equipment. In the spring of 1927, a better field organization was perfected, some additional construction



Sketch map of the platinum districts of Ural Platinum Trust

equipment was installed, and the work of completing the dredges was carried on in earnest. On June 30, 1927, the first dredge was put into the water after being under construction for 395 days, an average construction crew of about 115 men being employed. Approximately 50 per cent of the cost of construction of the dredges was chargeable to the labor involved in pulling and hauling the various parts of the dredges into place with hand winches and gin poles. But the U.S.S.R. has profited by its first experience in the construction of modern dredges; more efficient construction crews have been organized; and power equipment is supplanting the hand methods which have been used for generations. I venture the opinion that future dredge work will be carried on progressively; that sufficient and proper construction tools will be used; and that the final costs of construction, as well as the time element, will reflect the advances being made within the U.S.S.R.

The first of the 13½-cu.ft. bucket dredges was put into operation on the pond at Visimo-Shaitansky Zavod on Nov. 8, 1927, seventeen months and eight days after construction of the hull was started. This was a big day

in the history of the dredging industry of the U.S.S.R., as it was also the tenth anniversary of the celebration of the Revolution. Representatives from the Supreme Council in Moscow were present, together with those from the various workers' organizations and from the head offices of the manufacturing and operating trusts. Speeches were made by the various representatives and the workmen. Appropriate music was furnished by the local village band, and the red banner, tied around the bucket line and the digging ladder, was severed by the district Soviet manager, with due ceremony, as the machinery of the dredge was officially put into operation. The following is a literal translation of the official invitation sent out for the occasion:

Invitation

The management of the Nizny Tagil Platinum District and the external management of Krasny Poutilovitz Zavod in Ural request you to be present at the triumphal start of the Electric Dredge No. 11 on Nov. 8, at 2 o'clock in the afternoon, on the pond of Vismo-Shaitansky Zavod. After the start, we have the honor to ask you to have a glass of tea at the School of Industry, with our compliments.

The management of the District and the external management of Krasny Poutilovitz Zavod in Ural.

I well remember the spirit of cordiality and friendship shown me by the peasants, the workmen, the engineers, and the officials of the Soviet government. This was ever prevalent during my stay within the U.S.S.R., but on this particular occasion it may have been augmented, no doubt, by the excellent tea, which ranged from 10 to 40 per cent!

The second 13½-cu.ft. bucket dredge in the Nizny Tagil district was put into operation about Dec. 10, 1927, and was thoroughly tested out before being shut down for the winter months. The third dredge was scheduled for completion on March 1, 1928, and the fourth was due to be completed on May 1, 1928. On July 1, 1928, the 7½-cu.ft. bucket dredge in the Kitlem district was still under construction. The work on it has been retarded by climatic conditions, the fact that it was necessary to haul the material from the railroad during the fall and winter months (as the roads are practically impassable during the spring and rainy season), and also because of the fact that the Soviet government was anxious to get the larger dredges on a productive basis in the Nizny Tagil district, which district affords better operating conditions and yields larger returns.

Placers Very Narrow in Places

The Nizny Tagil platinum placers will average 30 to 35 ft. in depth and are about a quarter of a mile in width at the widest places. In several places they are very narrow, and it is possible that the dredges will have to be taken through the cuts on a lead line, with which all are equipped in addition to the swinging lines and the spuds. The bedrock consists principally of limestone and dunite. Considerable slimes and slickings are encountered, as well as strata of clay. The season of operation of the dredges in this district is usually from about the first of May until the latter part of December, at which time the dredges are forced to stop work, as the cost of removing the ice which accumulates in the ponds becomes too great. The ground does not freeze enough to necessitate thawing, as is the case in the Alaskan fields, which are from six to eight degrees farther north.

Although considerable time was consumed in the erection of the dredges within the U.S.S.R., the work, as far as the construction equipment and local facilities would afford, was done in a thorough manner. Local laborers were generally used on the construction work, although a few of the better mechanics, along with the foremen, were brought from the Poutiloff shops in Leningrad. The older Russian mechanic is an excellent workman and is a thorough master of his trade. The younger generation shows the lack of the thorough and general training which the older workman had. However, much talent is available, which will unquestionably be developed as the U.S.S.R. is industrialized. The Russian engineers, exceptionally well educated, but trained in an intensive theoretical manner, are now gaining much practical experience as the U.S.S.R. is being put on a productive basis, and within a few years they will help to solve one of the greatest needs of the country —namely, experienced executives.

McIntyre Porcupine Mining Costs

THE annual report of McIntyre Porcupine Mines, Ltd., for the year ended March 31, 1928, gives the following distribution of mining costs per ton of ore:

Cost Per Ton of Ore Mined

Labor	$1.4551
Explosives	0.3423
Supplies	0.1622
Power	0.1109
Timbering	0.2886
Shaft repairs	0.0068
Back-filling	0.0140
Steel sharpening	0.1136
Drill repairs	0.0307
Surveying and engineering	0.0542
Sampling and assaying	0.0750
Pumping and ventilating	0.0320
Tramming	0.1654
Surface tramming	0.0096
Hoisting	0.3444
	$3.2048
Less: charged to undistributed development	0.4164
	$2.7884
Exploration	0.0777
Examination of prospects	0.0281
Net cost per ton	$2.8942

Unit costs are distributed as follows:

Stoping	$2.1429
Drifting	0.4352
Crosscutting	0.1775
Raising	0.0328
	$2.7884

McIntyre-Porcupine hoisted 521,456 tons of ore during the year ended March 31, 1928.

Luminous Pressure Waves

PHOTOGRAPHS of the explosion taking place when a cartridge of dynamite is detonated have shown the existence of luminous waves propagated at high speed in the air surrounding the explosive. It was at first thought by U. S. Bureau of Mines engineers conducting these experiments that the waves were merely reaction gases projected from the explosive, but further work in which the air around the stick has been replaced by hydrogen or carbon dioxide has made it seem probable that these are really pressure waves at such high temperatures that the gas actually radiates in the visible region of the spectrum. The work is part of a program of investigation by the Bureau of Mines of the sensitivity of explosives to detonation by influence.

A Geologic Error Regarding the *Wood River District*

By STEWART CAMPBELL
State Inspector of Mines, Boise, Idaho

THE recent extensive development work in the Minnie Moore mine, in the Wood River district, in Idaho, has proved beyond a doubt that the ore-bodies were formed prior to the intrusion of the diorite, and indicates that the sedimentary beds containing the lower end of the vein were elevated as a roof pendant, which was later removed by erosion. As a similar condition exists at no other mine in the district, the purpose of this article is to call attention to the fact that veins of the Wood River mining district were formed at two separate and distinct geologic periods; and that the proper consideration of this fact should have the effect of stimulating well-warranted development work, which is being retarded on account of an erroneous conclusion based on the unsuccessful outcome of exploration at the Minnie Moore mine. As that recent enterprise was the only serious attempt ever undertaken toward solving the fault problems encountered in any of the old mines of the district, its failure should not be used as a criterion for condemnation nor as an excuse to point the finger of suspicion at the oldest lead-silver producing region in Idaho.

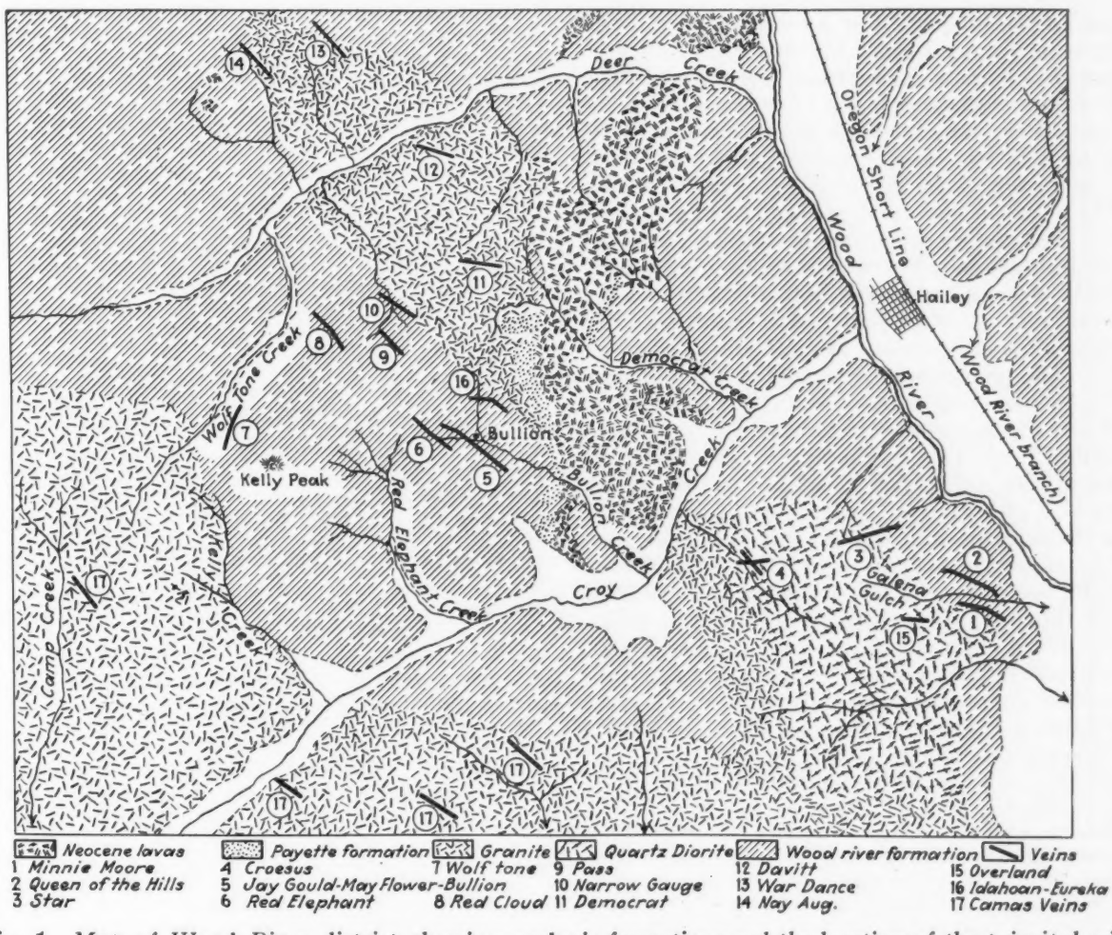


Fig. 1—Map of Wood River district showing geologic formations and the location of the principal mines

This district, one of the best known in the state, first attracted attention in 1878. The first locations were made near Hailey in 1879; and the first settlers arrived in 1880, since which time there has been a continuous production of high-grade lead-silver ore. The peak period, from a financial and production basis, was from 1883, the year of the arrival of the railroad, to 1893, the year of the demonetization of silver. There are no complete

records of the early-day production, but available historical data prove that estimates published by the U. S. Geological Survey for that period may be too low.

The Wood River mining district is situated in south-central Idaho, embracing practically all of Blaine County and parts of Camas and Custer counties. It comprises the drainage areas of Big and Little Wood rivers, including all of the Wood River Mountains and a part of the Smoky and the Sawtooth Mountains. It is served by a

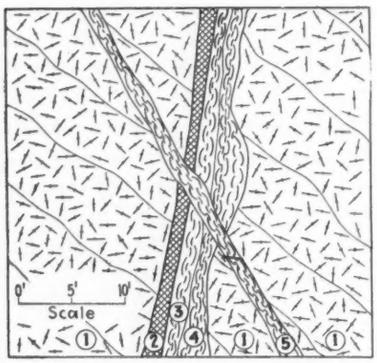


Fig. 2 — Cross-section, showing Crœsus veins and dike, 600-ft. level. 1, diorite; 2, intrusive dike; 3, 4, pyrrhotite gold vein; 5, lead-silver vein

branch line of the Oregon Short Line Railroad (Union Pacific System) from Shoshone to Ketchum, and by two state highways. County roads which are easily traveled by heavy motor trucks reach nearly every mine. The relief of the district ranges from 5,300 ft. above sea level at Hailey to 12,078 ft. on the summit of Mount Hyndman, the highest peak in Idaho. The elevation of the ridges, which lack a discernible system, averages about 7,000 ft. These ridges are generally smooth, show an accordance in level, and are overlain with a deep mantle of soil. The district borders on both the arid and the forest zones, and the north slopes of its mountains are covered with a heavy growth of firs and pines.

Geology—The geology of the Hailey section was worked out and described by Waldemar Lindgren[1] in 1900, and part of the Smoky and Sawtooth sections have been described by Joseph B. Umpleby[2]. In this region the predominating and oldest formation is the Wood River series (Carboniferous), composed of limestones, calcareous shales, quartzites, argillites, and conglomerates. The second oldest formations are Post-Carboniferous quartz diorite and granite, which are in turn followed by the Payette formation, principally sandstones and shales (Neocene?); and Miocene lavas—andesites and trachytes, with their tuffs (see Fig. 1). The Payette formation and lavas are barren of mineral deposits.

Veins—Lindgren recognized three types of veins, which he described as follows:

"The predominating type of mineral deposits near Hailey, as well as in other parts of the Wood River region, as far as studied, consists of fissure veins carrying silver and lead in sedimentary rocks. The gangue is siderite, or intermediate iron-calcium-magnesium carbonates; the principal ore is galena. These veins are referred to as the Wood River type. A smaller group of veins of the same type occurs in granite. These are referred to as the Democrat type. Another less common class, occurring in diorite or granite and referred to as the Crœsus type, may be described as fissure veins carrying chalcopyrite and pyrrhotite, containing gold, in gangue of quartz and carbonates.

"The geologic features of the region clearly indicate the age of the veins as Post-Carboniferous and post-granitic on one hand and as Pre-Miocene on the other hand. If, as seems probable, the granite is of Juratrias or Cretaceous age, in common with some many of the great intrusive bodies of the Cordilleran region, the age limits are still further reduced."

Although Lindgren recognizes three types of veins, which he classed as Post-Carboniferous, it will be observed that he did not attempt to divide them into different ages, but, on the other hand, permitted the conclusion to be drawn that they were contemporaneous. This was doubted by Arthur Lakes,[3] who in a later discussion of the district said:

"The veins so far developed lie in parallel zones, some near to the contact with the diorite, others occupying fissures at a greater distance. Commonly the fissure follows the contact line between shale or slate and a bed of limestone. Sometimes a fissure vein, after following the contact of shale and limestone for some distance, is found with a hanging wall of diorite and a footwall of limestone, the intrusive sheet of diorite having bulged or come down directly on to the limestone. At other times the fissure may be confined wholly to the slate, and occur in lenticular bodies in it.

"In the overlying diorite and in the eruptive granite, fissure veins of the normal type occur, carrying mostly lead and silver, like those in the sedimentary rocks. These granitic veins have often the same dip and strike as the veins in the sedimentaries, and were probably filled and formed contemporaneously with them; *although there is a possibility of two periods of vein and fissure formation.*"

At the time Lindgren and Lakes wrote the foregoing, there was but one known vein (gold-copper) in the Crœsus mine. Later development work encountered a

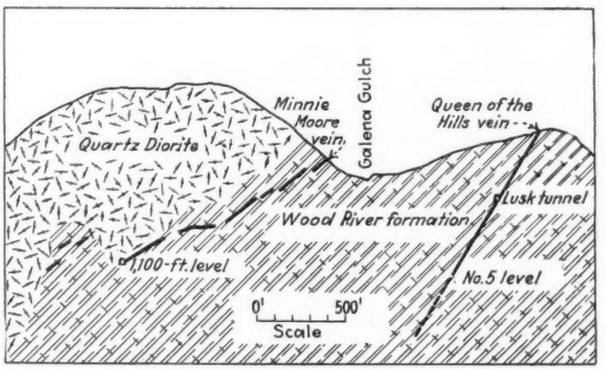


Fig. 3—Cross-section, showing geologic structure of Minnie Moore and Queen of the Hills veins

lead-silver vein, which was described by R. N. Bell[4] in part as follows:

"One of the most important producers of the year was the Crœsus mine, 3 miles west of Hailey. . . . It is developed by a three-compartment vertical shaft 800 ft. deep, with eight levels, and made a production during the past year of 40 cars . . . of which 20 cars were rich lead-silver ore and 20 cars of high-grade gold-bearing pyrrhotite mineral. This interesting yield of sharply contrasted smelting ores from the same shaft comes from the development of two distinct veins. . . .

"The formation at this point is the regional granodiorite mass that overlies the Minnie Moore, and the orebody in the gold vein is accompanied by an intrusive dike of dark-colored, fine-grained igneous rock like diabase or basalt. This vein stands nearly vertical and strikes nearly east and west. . . .

"The lead-bearing fissure is also of good size and strength; it was discovered at the seventh level and has subsequently

[1]Lindgren, Waldemar: "The Gold and Silver Veins of Silver City, De Lamar, and Other Mining Districts in Idaho." U. S. Geological Survey Twentieth Ann. Rept., Pt. 3, pp. 104-106, 211-217; 1900.

[2]Umpleby, J. B.: "Ore Deposits in the Sawtooth Quadrangle, Blaine and Custer Counties, Idaho." U. S. Geological Survey, Bull. 580, 1915.

[3]Lakes, Arthur: "The Bellevue Mining District." Mines and Minerals, Vol. 23, pp. 271-272, Jan., 1903.

[4]Bell, R. N.: Ninth Ann. Rept., Mining Industry of Idaho, pp. 51-53, 1907.

been opened at the eighth level and up to the sixth level, where it crosses the gold vein. . . . (Fig. 2.)

"This is a remarkably interesting contrast of minerals in such close association, the formation being the same in both veins, but the ore distinctly different, *and indicates a separate period of mineralization and a different source of ore solutions.*"

Faulting—There are no recognized large faults or general fault systems in the Wood River district. All faulting is localized, and faults in one vein may have no relation to those in any other vein. The term "Wood River fault" is a myth, and the impression that all the veins are faulted is erroneous. A large number of orebodies have been mined to exhaustion in depth and others have been abandoned because of economic conditions, without faulting of any consequence ever having been encountered. Some of these veins are entirely within the Wood River formation; some cross the contact between the Wood River series and the granite; some are in the diorite; and others are in the granite (Group No. 1). The only veins which are extensively faulted lie wholly within the Wood River formation (Group No. 2). Typical examples of the foregoing as arranged are: Queen of the Hills (Wood River formation); Star (Wood River formation and granite); Nay Aug (Wood River formation and granite); Crœsus (diorite); Overland (diorite); Democrat (granite); Camas "Hailey Gold Belt" veins (granite); and Minnie Moore, Jay Gould-Mayflower-Bullion, and Red Elephant (Wood River formation).

Significant Geological Distinctions

That all of the veins are not faulted and that there may be no relation between the faults and the continuity of ore in one vein and those in another is well shown by a comparison of the Minnie Moore and the Queen of the Hills (Fig. 3). These veins are approximately parallel, about 1,000 ft. apart. Each has about the same dip, although the Queen stands at a little higher angle; and each closely follows the general dip of the formation which both cut in dip and strike. The ore in the Minnie Moore consists of galena, tetrahedrite, and a little pyrite, in a gangue of coarse crystalline siderite and some quartz. The ore in the Queen of the Hills consists of galena, sphalerite, and tetrahedrite, in a gangue of quartz, siderite, and unreplaced wall rock. Each orebody has been mined on the dip of the vein for about 1,000 ft. At no place in the Minnie Moore were the vein or orebodies continuous in dip for more than 200 ft.; they were intersected by numerous normal faults, and in some instances the faulted blocks were displaced horizontally more than 400 ft. The only fault of any kind encountered in the Queen of the Hills was one small displacement of about 12 ft.

From this comparison it is obvious that the principal movements occurred after the mineralization in the Minnie Moore vein, and prior to it in the Queen of the Hills. A similar relation between faulting and continuity of ore is apparent in other veins throughout the district.

Age of Veins—The geologic and structural features of the district clearly indicate that all mineralization did not take place simultaneously; hence, all the veins are not contemporaneous. As this evidence shows that the veins must belong to two chief groups, they can be classed as Pre-Carboniferous granitic intrusion (Group 2) and Post-Carboniferous granitic intrusion (Group 1), as available data to fix the age of determination more closely are lacking.

Conclusions—The Hailey section of the Wood River district once contained 280 producing mines. With only a few exceptions, practically no work has been done on any of them for many years. This area is highly mineralized, and it is the second largest lead-silver producing district in Idaho. The records and geologic conditions of many of the old mines are sufficiently interesting to warrant close investigation, particularly if the facts—that the veins were formed at two separate and distinct geologic periods, and that the faulting of one vein may have no relation to that of another—are given recognition.

Lubricating Inside of Piston Pumps

By Thomas C. Hulton
Abras Grandes, Province de Camaguey, Cuba

PLUNGERS in an outside-packed pump may easily be lubricated as they work back and forth, but the inside-packed plunger and piston types do not offer any ready means of lubricating. At times it may even seem impossible. The piston type of pump often rolls its packing rings into something resembling scraps of rope. This is caused by lack of lubrication. The cure is simple.

Have ready on the steam chest, or other hot place, a can containing molten tallow—common beef tallow. Make a swab with a piece of stiff wire and a small bunch of waste, clean the old packing out of the cylinder, and swab the cylinder lining thoroughly with the molten tallow. Repack the piston as usual, and notice how much longer the packing lasts.

Also, when you have occasion to open up the water cylinder again, you will be surprised at the length of time the tallow is retained, even when the water being pumped is moderately warm. Besides saving time and worry, this procedure will also save packing. It will be apparent that inside-packed plunger pumps can be given the same treatment.

New York & Honduras Rosario Operating Costs

THE annual report of the New York & Honduras Rosario Mining Company gives the following details of the company's operating costs in 1926 and 1927:

Honduras Operating Costs

Operating Basis:	1927	1926
Dry tons milled	108,400	109,670
Ounces silver produced	2,172,198	2,483,101
Ounces gold produced	5,601	5,645
Total troy ounces bullion produced	2,177,799	2,488,746
Feet exploration and development driven	18,892	16,263

	Total Costs		Per Ton Costs	
Mine	1927	1926	1927	1926
Labor	$275,121	$258,013	$2.54	$2.35
Supplies	164,628	155,821	1.52	1.42
Power	6,664	6,698	0.06	0.06
Total	$446,414	$420,532	$4.12	$3.83
Mill	1927	1926	1927	1926
Labor	$56,029	$54,131	$0.52	$0.49
Supplies	177,030	204,377	1.63	1.86
Power	9,815	11,117	0.09	0.10
Total	$242,876	$269,626	$2.24	$2.45
Honduras administration	135,029	117,889	1.25	1.07
Total	$824,320	$808,048	$7.61	$7.35
Credit value of gold produced	112,014	112,902	1.03	1.02
Net cost of silver	$712,305	$695,146	$6.58	$6.33
Cost per ounce silver produced	$0.327	$0.279	.....	.....

Increase in the total operating costs in 1927 is largely accounted for by an increase in the amount of development and exploration work.

The new irrigation dam in the Gila River

The Morenci Concentrator of the Phelps Dodge Corporation

Part XV: Revisiting Arizona Mining Camps

By E. H. Robie
Associate Editor

AFTER spending a few days in Superior, Miami, Globe, and Hayden, as already related, my next objective was the Phelps Dodge operations at Morenci and Clifton. A comfortable Studebaker bus leaves Globe about 8:30, following the Gila River valley to Safford, where one stops for lunch. The Gila valley, with irrigation, assumes the aspect of an extended oasis, with crops of cotton, alfalfa, and grains. Soon after leaving Globe, one passes through the San Carlos Indian Reservation and near the site of the immense irrigation dam now nearing completion. This is officially known, I believe, as the Coolidge dam, though some local sentiment prefers that it be called the San Carlos dam. To me the Spanish name seems more appropriate. To be sure, the Salt River dam was named after President Roosevelt, but he was much more closely associated with the West than President Coolidge has been, and took a particularly active interest in reclamation projects. The San Carlos dam, or the Coolidge dam if you prefer, is of the multiple-dome type as clearly illustrated in the accompanying photograph, there being three domes at 180-ft. centers. Gila Canyon at this point is about 250 ft. deep and 600 ft. wide, the dam being approximately of these dimensions. The contract price was two and a quarter million dollars. Construction will probably be finished within a few months. This dam will afford irrigation for 123,000 acres of potential agricultural area near Florence and Casa Grande (you will pronounce Grande in two syllables if you wish to follow local custom), and is also destined, I believe, to generate some power.

From Safford, another Studebaker, a touring car this time, took us over the mountain to Clifton, a two-hour trip of rather steep grades and attractive distant views. At Clifton, we met the San Francisco River, a tributary of the Gila, which is here twice bridged to connect the town lying on either side. Fortune favored me here at the Reardon Hotel, where I was able to secure a room with bath, a convenience especially welcome after a dusty day or two of travel and after suffering from the limited facilities in this respect at some of my other stopping places. I urge travelers to reserve accommodations in advance, where possible, at hotels in Arizona, and to have no hesitation in asking for the best.

At Clifton is the smelter of the Phelps Dodge Corporation, treating the concentrates from the mill at Morenci, 7 miles to the westward and about 1,500 ft. higher altitude. The mine at Morenci is the largest potential resource of the company, and without doubt will be its principal property in the years to come unless important new discoveries are made elsewhere. In March, an average of 4,268 dry tons a day of 2.2 per cent copper ore was being mined and concentrated, practically all of this coming from the Humboldt mine. A Wellman-Seaver-Morgan direct-connected hoist operates about one skip per minute, each of 4.6 dry tons, with a 470-ft. lift. Additional hoisting equipment will probably be required in a year or two if capacity is to be expanded. Soon no pumping will be required at this mine, as all water will be removed through a 4,300-ft. drainage tunnel, now near completion.

The principal ore mineral is chalcocite, in association with pyrite; about 10 per cent of the copper sulphides

are oxidized and soluble in acid. The gangue is a decomposed quartz porphyry, also high in alumina. Most of the mining is by top-slicing, though I shall not here go into the details of practice. Last year all the grizzlies underground were changed from 10 to 16 in., necessitating a new 36x48-in. jaw crusher in the coarse-crushing department of the concentrator.

The flow sheet of the plant is shown in detail in another column, which includes a few changes now in progress. Essentially it consists in crushing in a jaw crusher to 6 in.; then by gyratory, Symons disk, and roll crushers to about 1 in., at which size it is stored in the fine-ore bins. After withdrawal from these bins the pulp is screened to 7 mesh, with secondary crushing in rolls, and then tabled, making a finished concentrate. The combined middling and tailing from the tables is ground in ball mills to 48 mesh and then floated in a primary flotation system, the tailing from which is reground in a closed circuit of classifiers and ball mills, to 65 mesh. Final flotation concentrate, representing a recovery of about 87 per cent of the total copper and 93 per cent of the sulphide copper, is thickened, filtered, and shipped to the Clifton smelter.

The principal new feature in the coarse-crushing department is the 36x48-in. jaw crusher installed about a year ago when the size of the mill feed was increased from 10 to 16 in. This is driven by a 150-hp. ball-bearing General Electric motor equipped with Tex-rope drive, an installation that has been very satisfactory, one broken ball being the only grief so far experienced. The other machinery in the coarse-crushing department requires little comment. On the rolls, 6-in. Midvale steel shells are used for replacements, and the following data may be of interest in showing steel consumption:

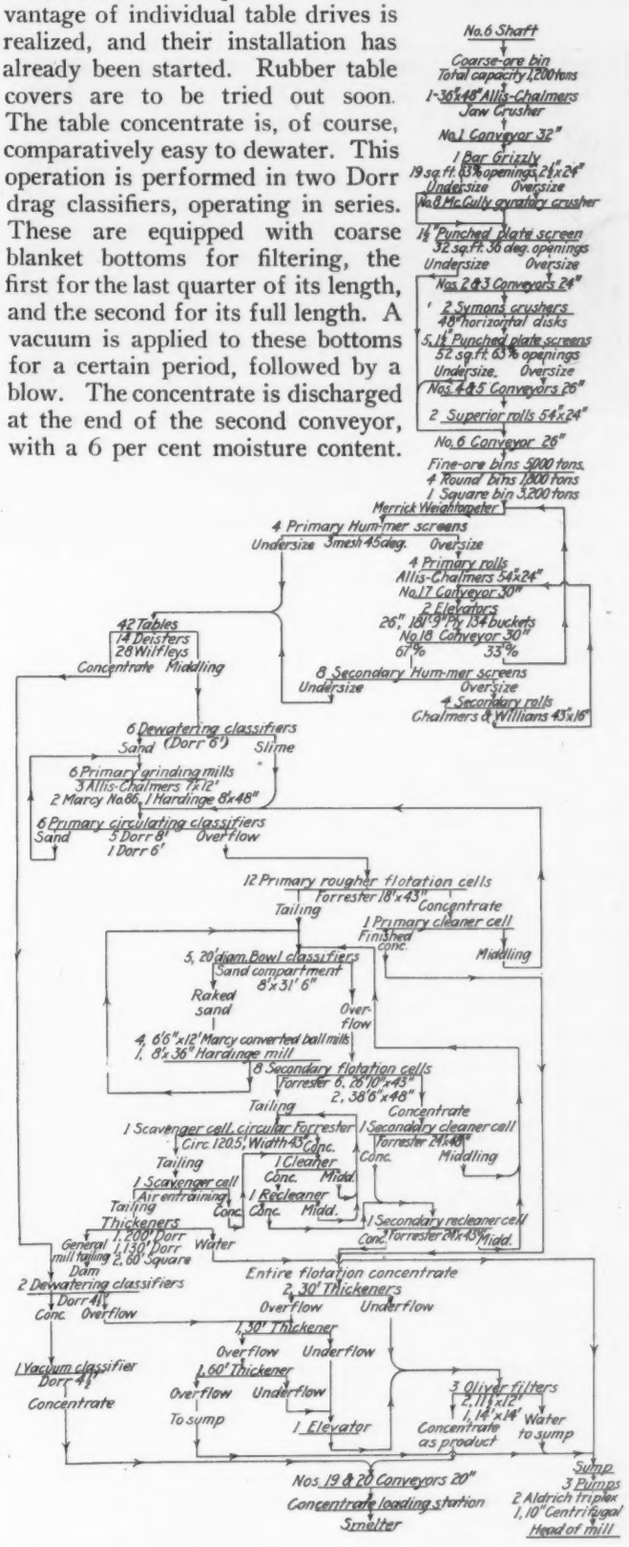
Pounds Steel Consumed in Roll Shells per Ton of Ore Crushed, Secondary Crushing Department

Size Rolls	Total	Less Scrap	Per Cent Useful Steel	Average Life, Days	Average Tons Crushed per Pair of Shells
54x24 in.	0.029	0.023	79	349	375,145
43x16 in.	0.044	0.036	82	151	92,748

The disks recently replaced in the Symons disk crushers had an average life of 206 days.

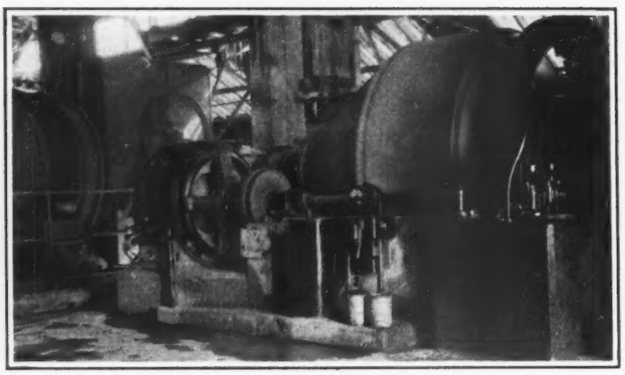
Before long, it is likely that two 7-ft. Symons cone crushers will be installed to replace the No. 8 gyratory, the two Symons 48-in. disk crushers, and two 54x24-in. slow-speed P. & M. rolls. The Symons cone crusher is a machine that I have not mentioned before in this series of articles, but one that has aroused the most favorable comment, I think, of any recent developments in milling equipment. The installation that has attracted the most interest is at the Chino mill, at Hurley, N. M., about which I shall say more in a later article; visitors there have been many, and they have come away greatly impressed with the large capacity and the great range of size that this machine can handle economically. Its introduction into Western mills promises to be extensive.

As will be noted in the flow sheet, all of the roll product, unclassified, is tabled. This is one of the few plants in the country to retain tabling of the entire mill feed ahead of flotation, so I naturally inquired whether this feature would be incorporated in a new plant if it were built. It is probable that it would, although this would depend somewhat upon the future grade of ore. For one reason, it affords a coarse product for the smelter which has no Cottrell plant. Such regard for the smelter would be entirely lacking if the concentrates were sent to a custom plant. Forty per cent of the entire concentrate is produced by the tables, which handle a daily tonnage of approximately 120 tons per table. The table concentrate contains about 32 per cent of the sulphide copper in the ore, and about 11 per cent of the acid-soluble copper. A layer of concrete is laid on the top of the tables as high as the riffles, and new riffles are then nailed on top of the original ones. Wooden riffles are used, rather than the rubber variety, which have given satisfaction at some plants. The advantage of individual table drives is realized, and their installation has already been started. Rubber table covers are to be tried out soon. The table concentrate is, of course, comparatively easy to dewater. This operation is performed in two Dorr drag classifiers, operating in series. These are equipped with coarse blanket bottoms for filtering, the first for the last quarter of its length, and the second for its full length. A vacuum is applied to these bottoms for a certain period, followed by a blow. The concentrate is discharged at the end of the second conveyor, with a 6 per cent moisture content.



Latest flow sheet of the Morenci concentrator

It then falls on a conveyor belt, where it is combined with the flotation concentrate, and is loaded direct on 42-ton railway cars for shipment to the Clifton smelter. Flat idlers have been substituted for the troughing type on the concentrate conveyor belts. The damp material stays where it is put even on a flat belt, and by eliminating the troughing there is less wear as a result of the flexing of the belt. The concentrate, after loading on the cars, is sampled by pipe samplers at 40 points in each car.



Scene in the secondary grinding department

Table tailing, or middling, is reground for primary flotation at 48 mesh, six mills being in use for this purpose—three Allis-Chalmers, 7x12 ft.; two No. 86 Marcy ball mills; and one 8-ft. x 48-in. Hardinge. The longer A.C. mills operate at 17 r.p.m., the Marcys at 15½, and the Hardinge at 17 r.p.m. The three A.C. mills are driven by synchronous motors, the others by induction motors, power consumption being 5.4 kw.-hr. per dry ton of ore ground.

Three-inch balls are used for grinding, the consumption being about 1.25 lb. per dry ton, and that of the liners, 0.13 lb. The mills average about 700 tons of feed per day each, 76 per cent of which is coarser than 65 mesh. They operate in closed circuit with 8-ft. rake classifiers, the overflow, 8 per cent of which is plus 48 mesh and 53 per cent through 200, going to primary flotation. The rougher flotation tailing is again classified and the coarser portion reground in the secondary grinding circuit. This part of the circuit has been changed this year, the accompanying flow sheet giving the practice as it is expected to be by October, the addition of bowl classifiers at this point being the distinguishing feature of the new practice. Four Marcy rod mills, 6 ft. 6 in. in diameter by 12 ft. long, are now being installed for this service, operating in closed circuit with 20-ft. diameter bowl and 8-ft. rake classifiers. Balls, however, have been found superior to rods for this fine-grinding service, and are accordingly used. Rod mills do not seem to be considered so favorably as ball mills for the finest grinding, though they still have many supporters as primary grinding mills. These secondary grinding mills handle about 1,000 dry tons of flotation tailing each per day, with a power consumption of 2.1 kw.-hr. per ton. Using 2½-in. balls, the ball consumption is about 0.5 lb. per ton, and the liner consumption, 0.04 lb.

Forrester flotation cells have been adopted as standard in both the primary and secondary flotation departments. Two reagents are used continuously: xanthate (Bear Brand), and steam-distilled pine oil (G.N.S. No. 5), in a circuit made alkaline with lime. Tarol (produced by the Hercules company) is added as a froth stiffener at times. About 0.08 lb. xanthate per ton of ore is standard, it being added in the form of a 7 per cent water solution from automatic feeders into the inlets of the ball mills. Formerly it dripped into the classifier overflow, but the later practice of putting it directly into the ball mills is considered slightly better. The pine oil used amounts to about 0.075 lb. per ton, and the lime to about 3.9 lb., or about a quarter less than was used two years ago. The pine oil costs about 8c. per pound, in carload lots, and the xanthate, 15c.

The method of cleaning and recleaning is made clear by the flow sheet, and the important metallurgical data, covering last year's operations, are given in the following tables:

Metallurgical Data, Morenci Concentrator Table and Flotation Work Combined, Year 1927

Assays, per cent	
Feed: Total copper	2.191
Acid-soluble copper	0.181
Tailing: Total copper	0.303
Acid-soluble copper	0.152
Concentrate: Total copper	22.497
"Insoluble"	16.60
Iron	25.50
Indicated recovery, per cent	
Total copper	87.361
Sulpnide copper	93.138
Acid-soluble copper	23.278
Iron	70.39
Actual recovery, per cent total copper	87.210
Ratio of concentration, tons into one	11.75
Indicated concentrate produced, tons:	
Tables	50,200
Flotation	74,038
Gallons of fresh water per dry ton concentrated	275
Dry tons of ore concentrated per operating day	4,045
Dry tons of ore concentrated per 24 hours' running time	4,177
Dry tons of ore concentrated per man-shift	25.19
Average number of men employed per operating day	160.55

Metallurgical Data, Morenci Flotation Plant Only, 1927

Average daily dry tons treated by flotation	3,860
Feed to flotation: Total copper, per cent	1.58
Acid-soluble copper	0.17
Sulphide copper	1.41
Flotation concentrate: Total copper, per cent	24.55
Acid-soluble copper	0.45
Sulphide copper	24.10
Iron	20.99
"Insoluble"	22.06
Flotation tailing: Total copper, per cent	0.30
Acid-soluble copper	0.15
Sulphide copper	0.15
Flotation recovery: Total copper, per cent	81.80
Sulphide copper	89.86
Acid-soluble copper	14.13
Ratio of centration	19.04:1

Yearly Composite Screen Analysis of Flotation Concentrate

Mesh	Per Cent Weight		Per Cent Total Cu		Total Weight Copper Cum.	
	Ind.	Cum.	Ind.	Cum.	Per Cent of Total	Per Cent of Total
+65	16.2	16.2	13.32	13.32	8.79	8.79
100	10.6	26.8	15.46	14.15	6.68	15.47
150	10.4	37.2	18.54	15.39	7.85	23.32
200	12.2	49.4	22.12	17.05	10.99	34.31
270	9.8	59.2	27.20	18.75	10.86	45.17
300	2.2	61.4	30.68	19.16	2.75	47.92
325	4.8	66.2	31.84	20.08	6.23	54.15
-325	33.8	100.0	33.30	24.55	45.85	100.00

Yearly Composite Screen Analysis of General Tailing

Mesh	Per Cent Weight		Per Cent Copper			Per Cent a.-s. Cu is of Total Cu	Per Cent Sulphide Cu is of Total Cu
	Ind.	Cum.	Total	A.-S.	Sulp.		
+65	11.4	11.4	0.49	0.06	0.43	12.34	87.66
100	8.6	20.0	0.26	0.04	0.22	15.63	84.37
150	8.4	28.4	0.22	0.05	0.17	23.24	76.76
200	8.2	36.6	0.19	0.05	0.14	26.28	73.72
—200	63.4	100.0	0.30	0.21	0.09	69.88	30.12
Total	100.0	....	0.30	0.15	0.15	50.17	49.83

It will be evident from an inspection of the screen analyses that the greater part of the sulphide loss is attributable to insufficiently fine grinding, whereas, con-

sidering the acid-soluble copper, it is the extremely fine slime that is difficult to recover. With this knowledge, an attempt is being made to improve conditions through the use of bowl classifiers, as already mentioned. Until recently, six ordinary 14-ft. tank thickeners were used at this point. The aim is to reduce the plus-65-mesh material so that not more than 2 per cent of particles of such coarseness will be present in the mill tailing. By so doing, it is expected that, as a minimum, one additional pound of copper can be recovered per ton of ore treated. A trend toward finer grinding is in evidence at most of the Western flotation plants, as perhaps I have mentioned before.

The power consumption of a mill is always of interest, and through the kindness of Mr. Crowfoot I am permitted to give the details of the power distribution at this plant:

In Kilowatt-Hours per Dry Ton Concentrated

Jaw crusher	0.13	Lime mill	0.03
Primary crushing	0.80	Mill shops	0.02
Secondary crushing	2.05	Assay office	0.02
Primary grinding	5.18	Magnets and cranes	0.02
Secondary grinding	1.93		
Flotation blowers	0.99	Total mill consumption	13.65
Mill pumps	1.62	Line loss	0.32
Mill lights	0.32		
Concentrate handling	0.54	Power house delivery	13.97

The power required for the flotation blowers has been decreased materially by the installation of the Forrester type of cells. About half of the total power used comes from the waste-heat boilers at the Clifton smelter; the rest is generated by six 815-kva. Nordberg Diesel engines, three of which have been transferred from the Tyrone plant. Oil-engine power costs about 0.9c. per kilowatt-hour here.

Oliver filters are used for dewatering the flotation concentrates, these being covered with Oakdale filter covers, which have a life of between three and four months of actual use.

Water consumption amounts to about 1,350 gal. per dry ton concentrate, 80 per cent of which is return water. Aldrich triplex pumps, 12x16 in., with a capacity of 2,300 gal. per minute, are used, the head being 260 ft. An 8-in. centrifugal Allis-Chalmers serves as a standby unit.

Lime now being used extensively in the mill (about seven tons a day), apparatus for its local manufacture was installed some years ago. A kiln was constructed out of the old steel stack at the Shannon smelter, in Clifton. A good grade of limestone is available near by, and the entire operation of quarrying the stone and making the lime costs only about $6 a ton. About a quarter of a ton of fuel is required per ton of product. This contains about 90 per cent of total calcium oxide, and about 85 per cent of available. The burnt lime is crushed to $\frac{3}{4}$ in., stored in a steel bin which is drawn as required, and ground in the first Marathon mill that was ever made, secured from the old plant of the Detroit Copper Mining Company in the vicinity. Balls have been substituted for the rods originally used in this mill. The grinding is carried out in a closed milk-of-lime circuit, the requisite supply for the concentrator being drawn off from the tank containing the circulating solution and introduced into the pulp at the following points: the primary screen undersize, the grinding mill feed, and in the concentrate and tailing launder. Arrangements were being made at the time of my visit to treat fresh water with lime directly as it comes from the kiln, eliminating the storage of unslaked lime.

Especial attention is paid to the prevention of accidents at Morenci, numerous plans to keep the "Safety First" idea before the men being employed. From Nov. 10, 1926, to Feb. 10, 1928, the mill operated 81,000 shifts without a lost-time accident. During this time, the average number of employees was 158. Incidentally, the labor efficiency is also good, 25 tons being treated per man-shift. The operating crew is responsible for 38 tons per man-shift, and the repair crew for 74.

The mineral distribution in various screened products is also available, so that the fullest information is at hand regarding the manner in which losses occur. This is a great aid to intelligent operating and one that has only recently come to be realized by the larger companies. Most of the smaller mills have not yet given it consideration, but they might well do so, not, perhaps, to the extent of engaging the full-time services of a microscopist, but at least a study might be made by an outside specialist.

Many individual features of mill practice might be discussed had time permitted my studying them. The microscopic examination of mill products, for instance, could well form the subject of a paper all by itself. The mill feed, concentrate, and tailing are constantly the subject of microscopic examination to find what minerals are present, the degree of oxidation, the character of association, and other related information that will aid in an understanding of the grinding and flotation problem. I have before me, for example, the December composite analyses, showing the following mineral distribution:

Percentage of Mineral Present in Feed, Concentrate, and Tailing

		Concentrate		
	Feed	Table	Flotatn.	Tailing
Pyrite	3.50	59.0	38.0	0.26
Chalcocite	2.08	22.2	31.8	0.17
Covellite	0.09	0.4	0.8	0.02
Cuprite	0.12	1.2	....	0.09
Malachite	tr	tr	....	.r
Native copper	tr	tr	....	tr
Chalcopyrite	tr	tr	tr	.r
Bornite	tr	tr	tr	tr
Pyrrhotite	tr	....	....	....
Magnetite and hematite	0.19	2.0	tr	0.14
Gangue (by difference)	94.02	15.2	29.4	99.32

The Phelps Dodge Corporation also has a large property at Tyrone, N. M., known as the Burro Mountain branch. This has not been operated for some time, and much of the equipment formerly installed there has been distributed among the other plants. This was one of the most attractive copper camps in the Southwest, and it is unfortunate that it has been forced temporarily to remain idle. A good tonnage of 2 per cent chalcocite ore in porphyry has been developed, though the ore contains from 15 to 17 per cent of oxidized copper. Recent work, under the direction of Ben Cody, has been confined to the operation of a small test plant handling about half a ton a day, utilizing sulphate roasting and leaching. Electrolytic copper of better than 99.97 per cent grade has been made.

I think there is a tendency to extend hydrometallurgical methods more and more into the realm of sulphide ores, particularly where appreciable quantities of acid-soluble copper are present. In the Morenci practice, for example, only from 20 to 25 per cent of the acid-soluble copper is recovered in the table and flotation concentrate. Were the a.-s. copper content of the ore higher than around 0.2 per cent, the loss would be rather important. As sulphate roasting can be carried on for perhaps 40c. a ton, leaching is worth consideration, even on Morenci ore. Or a modification of the Inspiration practice might be devised. With a mill recovery of not over 90 per cent,

followed by a smelter recovery of 95 to 98 per cent, the 96 per cent or thereabouts that can be recovered by leaching and electroltyic precipitation will go far to offset the increased cost of investment.

The visitor notices few changes about Morenci. Frank Ayer is now the genial manager of this branch of the Phelps Dodge organization, assisted by William M. Saben, and Arthur Crowfoot is mill superintendent. And he is not only a mill superintendent but a naturalist and a most genial host. Many varieties of plants grace the rock garden and lily pool surrounding his home; ivy even is admitted to the house, forming a graceful border along the ceiling of the living room. What better hobby could one have than the attractive diversion of making a beautiful garden spot in a land in which so much rock and desert abounds.

Ruby Mining in Burma

A Town of Native Miners and European Sorters—The Disappointing Spinel

By George Cecil
Lugano-Paradiso, Switzerland

ALTHOUGH countless decades have passed since the famous pigeon-blood rubies of Burma first attracted attention, they still are found, and in reassuring quantities. But only in one part of Burma are rubies met with, a certain mountain district north of Mandalay apparently having a monopoly of them. Sixty miles away is a port on the Irrawaddy River, Rangoon, from which the stones are shipped to London. The overland journey from the mountains is through one jungle after another, with *dakoits* and less intrepid robbers lurking behind the huge trees and in the dense undergrowth. A strong guard is sent with the precious boxes, sometimes to be overpowered, in which event the highwaymen decamp with the spoil, leaving the slain to the jackals.[1] At the foot of the mountains is a native town, Mogok, 4,000 ft. above sea level, the inhabitants of which devote their days to mining. 'Tis their only business interest in life. From childhood they have been brought up to look upon a ruby as the one thing on earth that is worth possessing. The plain (once the bed of a vast lake) surrounding the town affords endless opportunities for them; there is little of it that is not ruby-bearing.

At Mogok the mines look somewhat like excavations made for the foundations of a building. The workings cover many acres, and over the level bottom, some 35 ft. below the surface, are countless little trolley lines, crossing and recrossing each other. Cars used in mining are loaded with earth, hauled to the top and emptied into revolving drums, to which wash water is added. The residue harbors rubies, or so the miners hope. What is called the *rubble* is separated from the *shingle,* the detrital matter that hides the valuable gems, by screening. The gems are extremely difficult to see, for at first sight an uncut ruby is uncommonly like a pebble covered with mud, so that the utmost attention has to be devoted to the sorting. An inexperienced sorter might easily class as rubbish a valuable stone. This work is entrusted to Europeans, each of the sorters sitting at a table upon which the natives pour the *shingle.* The sorters scrape the earth off each piece, often working for half an hour without any profitable result; then suddenly a glint of color is caught and the stone is dropped through a hole in the lid of a locked box. The manager keeps the key.

At the end of the week the contents of the boxes are sorted and examined. The rubies are separated from the not particularly valuable spinels, which they greatly resemble, and are then classified prior to being placed in the safe. Occasionally a stone of exceptional color and size, a stone such as the late King Thebaw might have envied, is passed from hand to hand and duly admired. The sorters, watching the manager, take a lesson in the art of classifying, for only a practiced eye can tell a spinel from a ruby. Freak stones are also included in the haul from time to time, and very attractive some of them are too. Yet they fetch little money, in spite of the undoubted charm of their coloring. Perhaps some day the neglected freak will please an influential patron or patroness. More unlikely things come to pass.

Formerly, the mines were worked by natives; but upon the British government taking over the land, the Burma Ruby Mines Company was formed. This company originally had to pay a tax of 315,000 rupees a year, plus a share in the profits, but afterward the amount was reduced to 200,000 rupees and a 30 per cent commission, which still seems pretty stiff. The Burmese ruby miners are, however, let off lightly, for ground is leased to them at from 5 to 10 rupees a month, a mere fleabite. Still, they are not allowed to use machinery; the white man alone has the right to do that.

About fifty Europeans and Eurasians are employed by the company, several of them having the care of the 450-hp. electrical installation that works the pumps and washing machinery. With one thing and another they are kept busy, which is just as well, for life at Mogok is uneventful. Except for the weekly arrival of the English mail, there is little to interest one.

Every now and then a valuable ruby finds a strange home. Some time ago a Buddhist priest discovered one in his begging bowl, and children are sometimes seen playing with stones that are worth a tidy sum. They have been found in the possession of tattered coolies, who, upon being pressed to explain how they came by them, only looked foolish. Not long ago, a European loafer in Rangoon handed the native keeper of a cocaine den a fine ruby, demanding as its price the use of the establishment and its contents for the rest of his natural life. The cocaine merchant closed with the bargain—and quickly killed off his too-confiding customer, whose "natural" life had become an "unnatural" one.

The "up-country" Burmese speak of a white bird that is said to haunt the ruby district at certain times of the year. It is supposed to swoop down upon the mine in the dead of night, seize in its beak a priceless stone, and fly away to India. Returning, with its beak empty, the performance is repeated. The Burmans have a touching faith in the tale.

[1] Airplane transportation would seem to be in order here.—The Editor.

Mining Ore at the Broken Hill Proprietary

A Brief History of the Methods Used

By E. J. HORWOOD

Superintendent of Mines, Broken Hill Proprietary Company, Ltd., Broken Hill, New South Wales

E. J. HORWOOD

UNTIL recent years the mode of occurrence of the Broken Hill ore was supposed to be by the replacement of the country rock in and adjoining the original fissure, by lead and zinc in solution in underground waters. Though such action has admittedly taken place, it is now considered to have been subsidiary to the igneous origin of the ore, there being strong evidence of its having been forced into the fissure in a molten condition. Early development disclosed rich oxidized silver-lead ores, but subsequent exploration has shown that, varying from 300 to 500 ft. below the surface downwards, the ore consists of sulphides of about equal percentages of lead and zinc, the assays also showing silver.

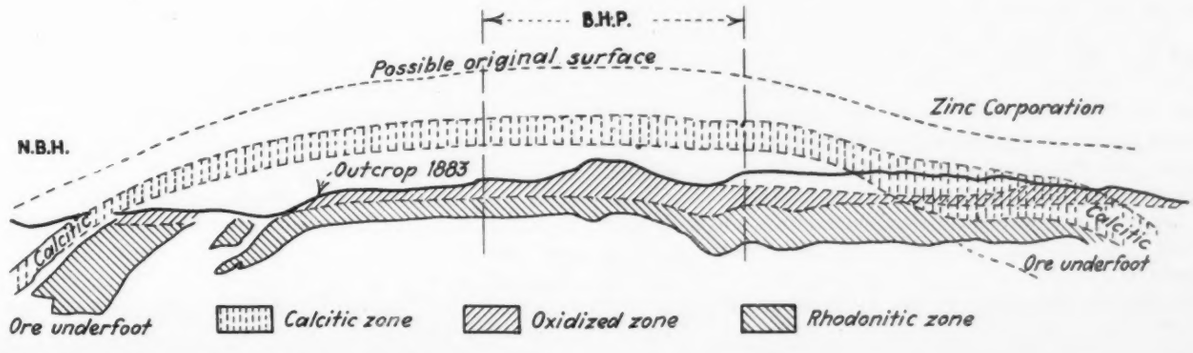
As the oxidized ores were in places much richer in lead and silver than the sulphide ore from which they were derived, and were almost devoid of zinc, it was evident that the original sulphides were acted on by the oxygen of the atmosphere carried down by the surface waters of past ages, when the rainfall was doubtless much greater than at present. Much of the silver and lead was dissolved and redeposited in the oxidized ore lower down, while the zinc was carried away in solution in the underground waters and to a certain extent redeposited on the sulphide ore below. This enrichment is illustrated by the fact that, although the average grade of the unaltered sulphides is from 11 to 13 per cent of both lead and zinc and about 11 oz. of silver per ton, some of the oxidized ores contained up to 75 per cent lead and several thousand ounces of silver per ton, and some of the semi-oxidized sulphide ore assayed as high as 30 to 35 per cent zinc.

The relative positions of the orebodies in the various mines at Broken Hill are illustrated by Fig. 1. There are two distinct classes of ore in the lode, one with a calcitic or carbonate of lime gangue, and the other with a rhodonitic or silicate of manganese and iron gangue. The calcitic ore occurs at the extreme north and south of the known ore deposits, pitching northward at the north end and southward at the south end. It would appear that in some very remote age the calcitic ore was continuous from one end to the other, as indicated in the sketch, and, owing to the volcanic earth movements pushing the central portion much higher than the remainder of the ore deposit, the calcitic ore originally in the central portion was exposed to denudation by torrential rains of past ages. Though this action robbed the company of much ore, it was largely compensated by the enrichment below the calcitic zone, which provided much easily smelted, rich, oxidized ore, of which other companies were devoid, and which enabled Broken Hill Proprietary to earn, for a time, up to £1,000,000 per year.

Owing to the great width of the orebodies, which vary from 20 to over 250 ft., and average over 100 ft., the usual Australian mining methods proved unsuitable. An American mining engineer by the name of Patton was then called in as general manager. He instituted the square-set system of stoping, consisting of 10x10-in. timber forming a framework 7 to 8 ft. high and 6 ft. long, horizontally, center to center. Each set represented a block of ore 7 ft. high and 6 ft. square. One of the advantages of this system was the number of working

Abstract of an address made by Mr. Horwood in New South Wales early this year, tracing the development of mining and metallurgical methods in his forty years' connection with the company. An article in a coming issue will be devoted to the development of concentration methods.

Fig. 1—Longitudinal section of the ore deposit



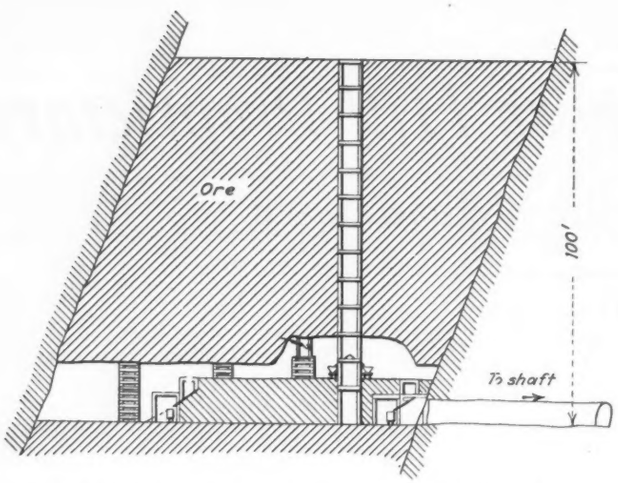


Fig. 2—A typical vertical cross-section showing open stopes

faces made available; another was the ease with which the broken ore could be sent down to the level below. A set alongside the level was lined off, forming a vertical box, into which the miners shoveled the ore and from which truckers on the level received the ore, taking it to the shaft to be hauled to the surface. The square-set system worked well so long as the excavation or stope was of moderate size. But, after experiencing a number of collapses, it became necessary to fill sections of the stopes with waste rock to reinforce the timbering. The ore in the American mines that Mr. Patton had worked was evidently much harder and more self-supporting than the oxidized ore at Broken Hill. Hence it could be supported by square-set timbers supplemented by bulkhead timbers, generally built in every fourth set.

Most of the unaltered sulphide ore could be mined by the open-stope method, as per Fig. 2, in which the only supporting timber necessary was where the ground appeared likely to flake off, when an occasional bulkhead, consisting of logs of timber, was built on the square. An open stope was generally started by widening an existing crosscut, the latter having a connection with the level above, to provide ventilation and a means of filling. The first, or sill floor, stope was carried up about 16 ft. high and in strong ground for the full width of the orebody and from 200 to 300 ft. long. Before any filling was put in the stope was close-floored with timber 3 to 4 in. thick. The object of this was to prevent the filling breaking away and running into the stope when the ore underfoot was being worked. Before filling was put into the sill-floor stope, drive timbers were erected to provide access and exit for trucking to and from the various parts of the stope as it advanced. When the sill-floor stope was sufficiently filled with waste (which, by the way, consisted of the residues of the original ore after the lead and zinc had been extracted), the ore was mined in the form of a horizontal slice about 8 ft. high, and when this slice had advanced sufficiently a layer of filling 8 ft. deep was placed in the stope, and so on, layer after layer, until the back or roof of the stope reached within about 30 ft. of the level above. At this stage the ore overhead—owing to the large area undermined—became too weak to permit of its being safely mined by the open-stope method, and square sets worked in small sections then became necessary.

To prevent the filling of the worked-out ground above from breaking away, it was generally necessary to work the square sets underhand. As illustrated in Fig. 3, the first thing done was to take the ore out immediately below the old bottoms, and as soon as room was made for the horizontal members of the square set, these were put in and were held in position by a cantilever, or boom, of timber 10 in. square, and blocking was placed between the set and bottom timber. The back or roof of the set or sets having been secured, the ore below was mined by underhand methods and square-set timbers were inserted as room was made, each frame being hung by laths from the one above. In strong ground it was sometimes safe to mine from the bottom upward, taking care to safeguard the old bottom flooring above.

The ore was run from shoots alongside the various drives and crosscuts under the stopes into trucks of over one-ton capacity. These were coupled up in rakes or trains, of up to ten trucks, and drawn by horses to the shaft. These horses were mostly fairly heavy draught stock, and were sent down and up again at the beginning and end of each shift. Before large shafts were made, about 30 years ago, the horses had to be let down in a sling and were kept underground continuously. As they retained their good condition, they evidently reconciled themselves to living underground, though in one case, before electric lights were installed in the underground stables, one horse went blind. A unique happening was the birth of a foal underground. These horses displayed remarkable intelligence, and in some narrow crosscuts, where it was impossible to turn standing, the horse would practically sit on its haunches and swing its body around. The horses were trained not only to pull the trucks when ordered, but also to push them, a breast pad being attached below the collar for this purpose. A small lamp,

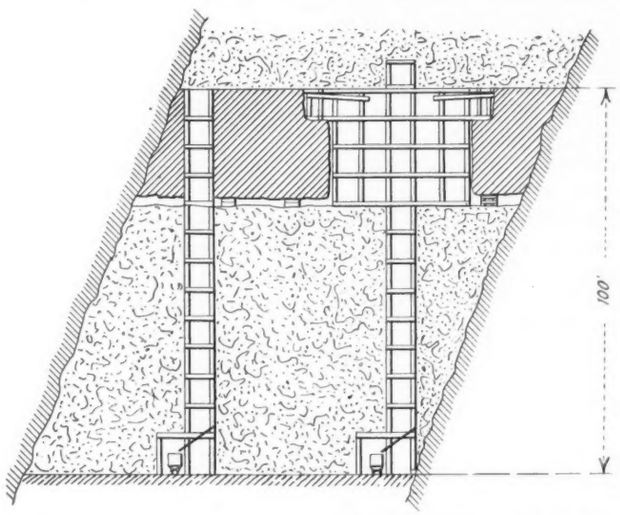


Fig. 3—Vertical cross-section showing underhand working

with a piece of candle, was suspended from the collar to give light for the horse.

Considerable trouble arose from underground fires in the early days, and some curious specimens were found when fire areas were reopened for working. One example was a dumbbell formed by the action of fire on a wooden ladder in contact with carbonate of lead. Two lumps of lead were formed from the smelting of the ore, one at each end of an iron rung of the ladder. Although it was rarely seen in the working faces, there were traces of mercury compounds in the ore; the fire

volatilized these traces, which, in the gaseous form, found their way with the products of combustion to the surface, where in the course of years, meeting the cool air, they were condensed and deposited on rocks near the surface cracks. Partly smelted ore, slag, and red oxide of lead were, of course, common occurrences.

About the year 1890, it was realized that the upper portions of the ore could be more advantageously quarried than mined by underground methods, and for nearly ten years this method was followed simultaneously with mining below, the deepest open cut being nearly 350 ft. below the original surface. Altogether about 4,500,000 cu.yd. was excavated, yielding 1,500,000 tons of payable ore. The limit as regards depth was governed by the amount to be removed to give the sides of the open cut a safe slope, or batter.

Copper Mining Will Be Reviewed in "Mineral Industry"

OUTSTANDING facts regarding the copper-mining industry of the world during 1927 may be summarized as follows:

1. United States mine production declined 3.5 per cent.

2. World mine production increased 2.6 per cent.

3. United States consumption declined 8.8 per cent.

4. World consumption increased 2.3 per cent.

5. World visible stocks declined from 411,615 to 362,934 tons.

6. Average New York price declined from 13.792c. to 12.930c. per pound.

7. Net earnings of American producers declined 8 per cent.

8. Cost of production was reduced about 0.5c. per pound.

9. Dividends paid by American copper mining companies increased about 5.5 per cent.

10. Excellent progress was made in organizing producers with the object of improving marketing practices.

The foregoing summary is the introduction to a comprehensive statistical and economic review of copper by A. B. Parsons, that will appear in the forthcoming issue of "Mineral Industry" (McGraw-Hill Book Company). Mr. Parsons continues:

"It will be observed that mines in the United States produced only 768,779 metric tons, against 796,522 in 1926, a reduction of 3.5 per cent. This is accounted for by deliberate curtailment of output designed to improve the statistical position, and thereby bolster up the price. In Peru, Chile, and Africa new producers entered the picture and at the same time older ones increased their output, so that these countries measurably increased their contribution to the world total. Spain and Japan produced less; Canada and Germany more. The net result was an increase from 1,479,270 to 1,519,394 metric tons, or 2.6 per cent. These data reveal 1927 as easily the best year in history.

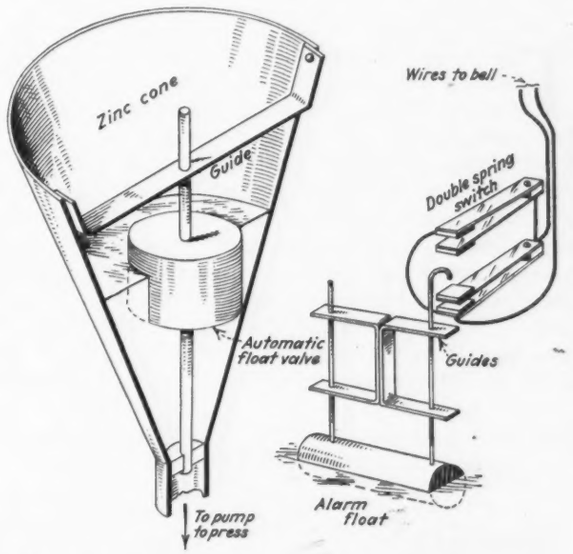
"Whereas in 1926 the United States consumed considerably more than half of the copper used in the world, 1927 saw a reversal in this respect. The large increases were in Europe, Germany being the outstanding factor with an increase of more than 60 per cent. Great Britain, Belgium, and Russia increased substantially, but France and Italy took considerably less, as did Japan. Estimated world consumption increased 2.3 per cent from 1,572,000 to 1,609,000 metric tons. The decline in the United States from 820,300 to 748,600 metric tons amounts to 8.8 per cent, whereas Europe as a whole used 16 per cent more than in 1926. Stocks of copper at the close of 1927 had declined substantially as a consequence, principally, of the shrinkage in the supply of "standard" copper in Great Britain.

"The average price for electrolytic copper, f.o.b. Atlantic seaboard refinery—generally called the New York price—declined from 13.792c. to 12.920c. per pound. However, it is significant that the average for the last five months of 1927 was 13.192c., compared with 12.726c. for the first seven months. Moreover, as this is written in May, 1928, it is possible to supplement the picture by adding the average price for the first four months of 1928: 13.877c., or somewhat higher than the average for the whole of 1926.

"The natural consequence of the decline of 0.872c. per pound in the price for copper was a material shrinkage in earnings. Net profit before depletion of 26 companies operating in North and South America that produced about 920,000 tons of copper annually in 1926 and 1927 was reduced from $81,706,000 to $75,123,000, or almost exactly 8 per cent."

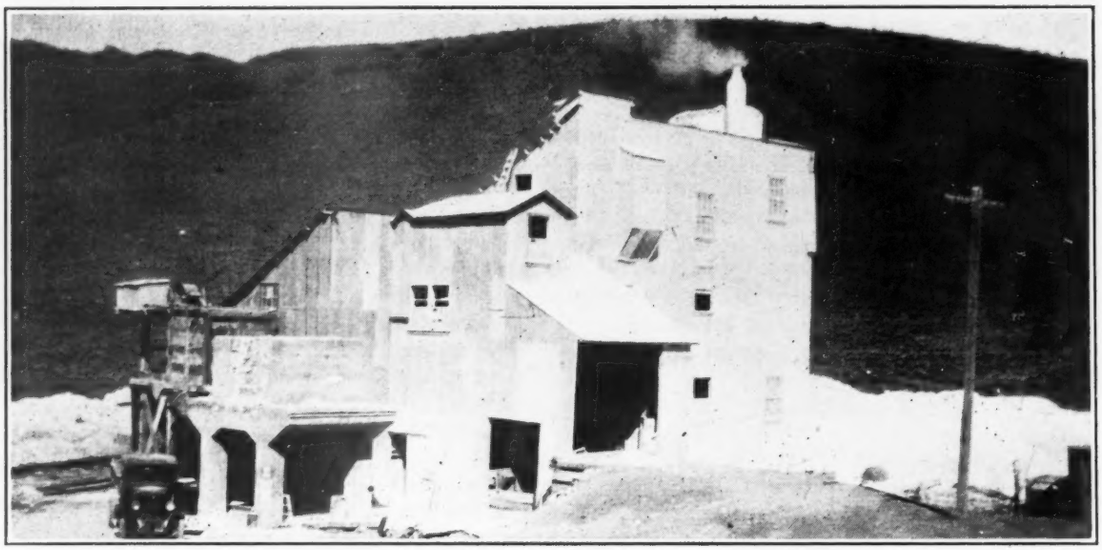
The North Star Zinc Cone

AT THE North Star cyanide plant, at Grass Valley, Calif., zinc dust is fed to a zinc cone which receives the deoxidized gold-bearing solution. A float maintains the solution at a constant level in the zinc cone which supplies the Merrill presses. Attached to the float



Details of zinc coné used in cyanide precipitation at North Star mine

is a conical valve, as shown in the accompanying sketch. To guard against stoppages, a second float is placed in the cone. This makes contact with switches whenever the solution falls below a given level or when it rises above the maximum level. The warning bell in either of these two contingencies attracts the attention of the attendant.



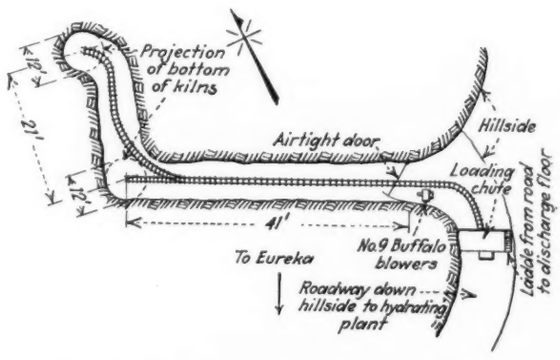
The hydrating plant

Lime Plant of Chief Consolidated, Near Eureka, Utah, Has Unusual Features

By H. D. KEISER
Assistant Editor

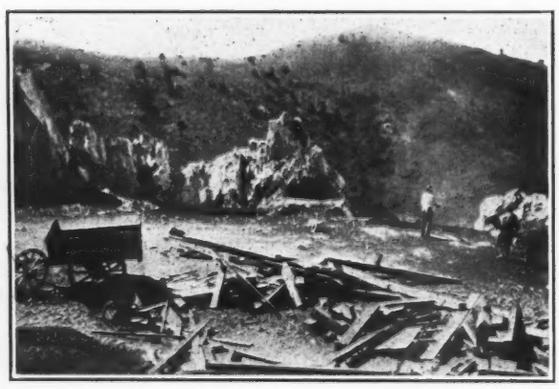
TWO miles northeast of Eureka, Utah, at Saddle, a station on the D. & R.G. railroad, the Chief Consolidated Mining Company is operating a lime plant that is unusual for its low labor cost, unique character of kilns, flexibility of rate of output, and the high grade of the product—Chief Brand high-calcium hydrated lime.

Construction of the two kilns used is the most interesting feature of the plant. These have been formed by raising through the limestone composing the quarry floor, the tops of the kilns being at the same elevation as the floor. Circular in shape and spaced 21 ft. apart on centers, both kilns are identical in size, being 65 ft. high, 12 ft. in diameter at the bottom, 15 ft. at the top, and



Sketch of discharge floor underneath kilns

Looking toward the tops of the kilns from the face of the quarry; the kiln on the right is being charged



18 ft. at half their height. Each is equipped with a steel hopper at the bottom, which supports a grate consisting of railroad iron spaced 5 in. on centers. Although the kilns have been operated steadily since they were constructed two years ago, slacking-off of the walls has been negligible, and no repairs of any kind have been necessary.

LIMESTONE AND COKE CHARGED TO KILNS

In charging the kilns a mixed feed of limestone and pea-sized coke from the Provo (Utah) plant of the Columbia Steel Corporation is used. The coke comprises 13 per cent of the charge. Total capacity of the two kilns is 100 tons of burned lime in 24 hours, two No. 9 Buffalo blowers being employed to furnish the

forced draft necessary when this output is desired. Any rate of production, ranging from 20 to 100 tons in 24 hours, may be obtained by regulation of the forced draft. When the electrically driven blowers are placed in operation, an air-tight door at the portal of the 65-ft. tunnel leading to the discharge floor of the kilns is closed. Air from the blowers is led to the bottom of the kilns through 10-in. galvanized tubing.

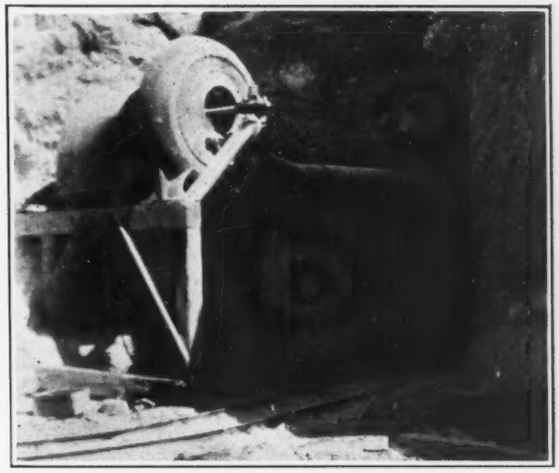
Ash Removed by Screening

A narrow-gage track runs from underneath the kilns to the loading chute outside, and, in drawing burned lime, a standard mine car is placed under the kiln, and discharge started by slightly moving the grate bars. The car is dumped at the loading chute, where the burned lime passes over a 1-in. stationary screen inclined at 45 deg. Undersize from the screen, which includes any ash present, is discarded to waste over the hillside. Lump lime

Loading chute and roadway at portal of tunnel

from the chute is transported 500 yd. by truck to the hydrating plant at the foot of the hill.

On reaching the hydrating plant the burned lump lime is first ground in a No. 1½ Sturtevant rotary crusher, and then treated in a Clyde batch hydrator, after which it is cooled and pulverized in a Raymond centrifugal mill. The product from the mill is conveyed to a storage bin feeding a Bates valve bagging machine that automatically fills the 50-lb. sacks with this weight of finished product.



A No. 9 Buffalo blower that supplies forced draft to the kilns

The capacity of the hydrating plant is 40 tons in 24 hours.

Recent samples of the quarried limestone indicate that it has the following average analysis: 97.2 per cent calcium carbonate, 0.9 per cent magnesium carbonate, 0.5 per cent alumina and iron oxide, and 1.4 per cent insoluble. A representative sample of the hydrated product, 99.12 per cent of which was minus 100 mesh, contained 95.72 per cent calcium hydrate and 1.93 per cent calcium carbonate; small amounts of calcium sulphate, magnesium hydrate, iron oxide, alumina, and silica accounted for the remaining 2.35 per cent.

The hydrated lime is marketed to smelting companies for use in baghouses, to various industrial plants for water-softening purposes, to mining companies for use in flotation mills, to the building trade as an ingredient of plaster and concrete, and to the oil industry for refining.

Four men comprise the operating force at the property; one man is employed at the hydrating plant, one drives the truck, and the other two men quarry the limestone and operate the kilns. H. L. Connelly, master mechanic of the Chief Consolidated Mining Company, is in charge of operations at the plant.

General view showing hydrating plant to the left and quarry on the hillside at the right

How to Prevent Mine Fires

A STUDY has recently been made by the U. S. Bureau of Mines of the fire in the shaft of the Magma Copper Company's mine at Superior, Ariz., which occurred on Nov. 24, 1927. A full report written by E. D. Gardner and D. J. Parker, has just been published as U. S. Bureau of Mines Reports of Investigations, Serial No. 2,882, from which the following conclusions as to methods helpful in preventing similar unfortunate occurrences in the future are drawn:

1. All main working shafts and stations should be concreted or otherwise rendered fireproof or fire-resistant; this applies especially to downcast shafts and to shafts in which men are handled.

2. All electrical equipment should be placed in a fireproof location and, if feasible, not in or near shafts or shaft stations.

3. Where feasible, power lines should not be taken down main shafts, unless the shaft or shaft compartment containing the cable is fireproof.

4. Main ventilation fans should be situated on the surface in fireproof housing and with a fireproof approach from the mine. Also, arrangements for prompt reversing of air currents in case of need should be available.

5. Stations and all workings should be kept clean of all inflammable material, and no refuse of any kind should be allowed to accumulate anywhere in a mine.

6. Signs should be posted and maintained in readable condition showing the way to emergency exits; all men should be instructed how to find these emergency exits.

7. Air-tight fire doors should be installed to separate different sections of the mine in case of emergency.

8. A fire door should also be installed in each opening leading from a shaft, preferably 100 to 200 ft. distant from it, so that the shaft could be isolated from the rest of the mine, as regards air flow, by closing the doors. The utility of the doors should be explained fully to the bosses and men. They may or may not be used at ordinary times. They should be kept in a workable condition in case of an emergency.

9. Explosives or detonator magazines should be of fireproof construction with substantial fireproof doors, and should not be situated within 500 ft. of a shaft. Preferably they should be so placed that if a fire breaks out in the magazine, the fumes will go into the main upcast air.

10. The placing of water lines on shaft stations is commendable; undoubtedly such an arrangement saved much additional damage to the Magma mine. It is suggested that the connections for hose attachments be placed at least 50 ft. from the shaft, so that they may be reached if fire occurs in the shaft.

11. Where temperature conditions allow, it is advisable to have at least 50 ft. of fire hose on each station attached to the fire line and ready to use by turning a valve to release the water.

12. All underground electrically driven fans, whether large or small, and even if used in one place for only a few days, weeks, or months, should be placed preferably in an untimbered region, or, if timbered, the location should be well fire-proofed.

13. Electrical wiring and equipment should be placed even more carefully than in surface installations and should be given at least monthly inspection by a competent electrician. Any defects found should be promptly corrected.

14. As a number of metal-mine fires are believed to have been started by either open lights or a cigarette, serious consideration should be given to methods for lessening these hazards. It would appear desirable to furnish safe storage-battery electric lights to cagers and other underground workmen who handle or work around inflammable materials. Also, rules should be promulgated and enforced prohibiting lighted carbide lights to be set down and left by themselves at any time. If not practicable to enforce a "no smoking" rule underground, smoking should be limited to prescribed areas in the mine where a minimum fire hazard exists, as is now being done at the Magma mine.

15. Apparently it would be desirable to have the cages on which men ride equipped with a signaling device that can be operated when the cage is either still or in motion. Undoubtedly two lives were saved at the Magma fire because it was possible for the shift boss to stop the cage by means of the pull cord.

16. During the Magma fire, the gunite acted definitely as a fire retardant, even though it did not prevent the fire from invading gunited territory. It appears that even when the fire burned the gunited timbered region, the progress of the burning as well as of the heat was retarded to such an extent that there was a minimum of caving, whereas there was a maximum of caving of ungunited timbered regions into which the fire extended. Hence, gunite aided very decidedly in reducing damage done by the fire, even though its influence on the decay of timber is held to have been harmful. It is entirely probable that if the No. 2 shaft of the Magma mine, and the station at the 2,250-ft. level, had been gunited, the fire that occurred on Nov. 24, 1927, would not have had an opportunity to start.

17. It is dangerous to send men down on a cage when there is fire in a timbered shaft, even though the shaft is downcast ordinarily and it is not intended to send the cage into or through the fire gases. Fire quickly climbs up a downcast timbered shaft and also converts a downcast shaft into an upcast.

18. In the Magma fire the facts that in less than an hour after the fire was discovered the pipe as well as the power and wire lines in the shaft were put out of commission, the shaft was converted from downcast to upcast, and the shaft was unapproachable from the stations off the shaft, indicate a few of the hazards of having main shafts lined with timber or other combustible material.

19. There is every reason to believe that the excellent ventilating system in the Magma mine allowed escape of many, if not all, of the 43 underground workers who came out alive; the foresight of the company in having three downcast shafts with hoisting equipment in them is to be given the highest commendation, and it is to this that many of the 43 fortunate men undoubtedly owe their lives.

Control of Platinum Market Desirable, Yet Difficult of Achievement

UP TO MARCH, 1927, the marketing of platinum was largely controlled by a syndicate consisting of Johnson & Matthey (London), Baker (New York), Marret, Bonnin (Paris), and Heraus (Hanau), according to a review which will appear in the forthcoming issue of "Mineral Industry" (McGraw-Hill Book Company), by Dr. G. F. Kunz, who, in addition to presenting complete statistics and other important and pertinent comment, adds:

"This syndicate had agreed to take from the Soviet government 60,000 to 70,000 oz. a year, on the condition that no Russian platinum be sold directly. But with the Russian production in 1925 and 1926 materially exceeding this amount, the Soviet representatives desired a larger allotment of the supply, while the syndicate on its part, due to increased production elsewhere, desired to reduce the Russian quota. As a result, the agreement was not renewed, and the Soviet output was put on the market directly in competition with the syndicate. In May, 1927, the Soviet government organized the Rusplatina to handle the distribution, and by the end of the year had sold an amount considerably exceeding the quota that had been previously allotted to Russia by the syndicate.

"Although no specific figures are available on the cost of production of Russian platinum, estimates place this at $40 to $50 per ounce. In view of this fact, and of the rapidly increasing production in Russia, the opinion has been freely expressed that the heavy decline in the price of platinum in the first half of 1927 was the result of Soviet manipulation of the market, in order to discommode other producers, practically all of whom have higher production costs, and particularly the new fields in South Africa. With prices still low, and a large proportion of the possible profits thereby forfeited, production is probably somewhat restricted below what it otherwise would be, but nevertheless the industry is still going forward. Although it is not likely that it will soon, if ever, reach the predominating position so enthusiastically predicted for it two or three years ago, this failure would seem to be attributable fully as much to the metallurgical difficulties encountered in handling the South African ores as to the price situation.

"Another view of the matter is that the price was forced down with the idea that the lower prices would lead to proportionately increased demand. With such a large percentage of the metal going into jewelry, where low prices are not necessarily the ruling factor, this may not be realized.

"While never controlled in the way or to the extent that the diamond market is, the price of platinum has for many years been more or less artificially inflated, but the present situation seems to promise a return to the rule of the law of supply and demand. If this be the case, a heavy overproduction would result disastrously for all concerned. The only other alternative would seem to be a rigid control, such as is maintained with diamonds. This has been repeatedly discussed and advocated for platinum, but the manifest difficulties in establishing a régime of this kind have thus far prevented any definite arrangement, and the breach between Russia and the previous syndicate would seem to make the possibility of the establishment of such a control more remote than ever."

Gold and Silver in Mexican Antimony Ores Cause Trouble

IT IS THE usual custom for the owners of antimony mines in Mexico, according to a recent issue of *Commerce Reports,* to turn them over to a native contractor, who operates them on his own account and undertakes to deliver clean ore that will average up to an established standard for an agreed price. During 1927 wages ranged from 2.50 to 4.50 pesos a day, the highest being paid to mine foremen. Nominally a working day consisted of eight hours, but this was seldom adhered to, especially on the contract work. A good supply of labor was available throughout the year, and there was little or no labor trouble.

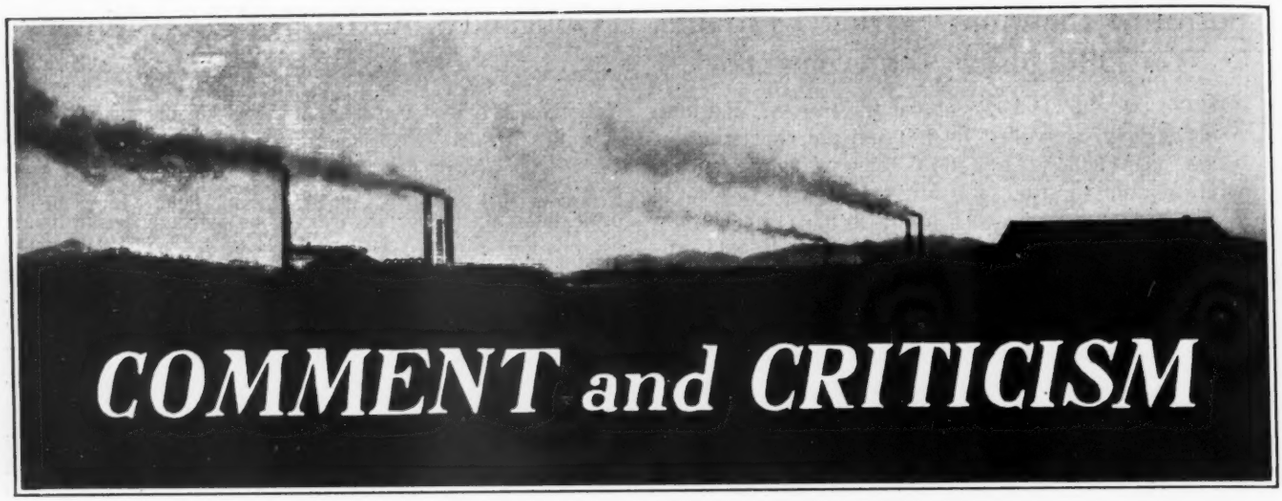
Besides the usual tax on mining properties, operators were called on to pay a federal and state production tax on all of the antimony mined. This tax has since been shifted to the purchaser of the ore. Where the ore contained silver and gold in appreciable quantities, as in certain local mines, a production tax was paid on these metals. Gold exported in antimony ore had to be reimported in the form of bullion or coin within 30 days of exportation. The natural result was that little silver- and gold-bearing antimony ore was sold. Silver in the ore appears to be a particularly detrimental impurity when antimony is to be used in the hard-lead trade.

A large part of the ore of the Altar district, State of Sonora, contains as much as 3 oz. of silver per ton, or 0.01 per cent, and the ore from several mines ranges as high as 30 oz. per ton. In many other mines, the ore assays less than 1 oz. of silver, or 0.003 per cent. Precious metals can be extracted from antimony ores, but the processes are patented and the royalties for their use are so high as to make them prohibitive at the present price, according to the report.

Ferrous Oxide a Metallurgical Mystery

THE Pacific Experiment Station of the U. S. Bureau of Mines, in its work on the determination of physical and chemical properties of the oxides of metallurgically important substances, has encountered the problem of preparing pure ferrous oxide. It seems to have been prepared pure by previous investigators only in minute amounts of less than $\frac{1}{10}$ gram, whereas samples of several pounds are desired for the usual determinations of specific heats, heats of formation and other related factors. The oxide is metastable below 500 or 600 deg. C., and must be prepared above and rapidly chilled through this range, to produce even relatively impure material.

A common method of preparation has attempted to reduce magnetite by means of metallic iron. Experiments carried out in a specially designed high-frequency induction furnace of vacuum type, and provided with a specially efficient means of chilling the product, showed that repeated treatments of fused iron oxides with pure iron between the melting point of the oxide and that of the iron consistently gave only about 85 per cent limiting purity. This constitution seems to be a steady or equilibrium condition, and the proof that such limits exist has important bearing on certain problems involving ferrous oxide, not only in connection with the metallurgy of iron but also with studies of the condition of copper-smelter slags and mattes.



COMMENT and CRITICISM

Lessons From the St. Francis Dam Failure

IN AN EDITORIAL in the issue of April 14, 1928, on "The Dam Disaster in California and Professional Co-operation," *Engineering and Mining Journal* stressed the need for "careful geological studies in advance of engineering projects that involve important structures like dams, tunnels, reservoirs, and the like." The subject is again brought to the attention of the public by the issuance of the report of a commission appointed by Governor Young of California. In a recent issue of *Science*, Dr. Chester R. Longwell, of Yale University, comments on the contents of this report, and discusses the problem in general, as follows:

"The disaster caused by failure of the St. Francis dam, near Los Angeles, California, on March 12 and 13 of this year, will long be remembered. Within a brief interval of time hundreds of lives were lost, a fertile valley was reduced to a scene of desolation, and property valued at many millions of dollars was destroyed. The general attention aroused throughout the country was due not merely to the magnitude of the disaster, but also to its unusual character. There have been few failures of large dams; and the collapse of the St. Francis structure, which was new and built of massive concrete, astonished engineers and laymen alike.

"With commendable promptness, the Governor of California appointed an impartial and able commission to investigate the causes of the failure. With commendable good sense he recognized the place of geology in the investigation and appointed two geologists to serve with four engineers. This commission made a thorough study of the problem in all its aspects, and a printed report was issued recently. The report is a brief, straightforward statement of facts and conclusions. It merits careful study by every civil engineer, every geologist, and every one who is interested in the relation of large structural projects to the public safety.

"The most significant conclusion of the commission is contained in one direct, unqualified sentence: 'The failure of St. Francis Dam was due to defective foundations.' So far as the evidence can show, the dam itself was perfectly sound both in design and in construction; but it goes without saying that the best dam in the world, if erected on a weak and leaky base, is a public menace. The degree of defectiveness in the foundations of the St. Francis structure is made clear by the report. Mica schist, a rock made up of thin, weak layers or folia, is the bedrock beneath the bottom and one side of the valley at the dam site. Conglomerate, composed of poorly cemented gravel and other detritus, underlies the other valley wall. Thus the bedrock is inherently weak under the entire dam; but to make matters much worse, the conglomerate and schist are separated by a wide zone of shearing, in which the rocks have been ground and mashed by powerful earth-forces. When a sample of material from this zone is placed in water it disintegrates rapidly to incoherent particles. Yet this mass of material lay directly under the dam, subject to the softening action and to the enormous pressure of water in the reservoir. It appears, then, that the foundation of the dam had many elements of weakness and none of strength.

"The geologic conditions in the valley, including the existence of the shear zone or *fault*, were well known to geologists before the dam was built. No competent geologist would have approved the dam site without serious reservation, and probably very few would have consented to construction of the dam in that place under any consideration. But it does not appear that any geologist had a hand in selecting the site, or in making inspection of the work as it progressed. Why not? The same geologists who took part in the 'post mortem,' as well as numerous others who knew the local geology, could have been consulted in the beginning. Their knowledge, had it been used at the proper time, would have prevented the catastrophe.

"It is easy to point out errors after the damage is done; and not infrequently certain individuals or organizations receive an unjust share of blame for which a common condition or system is responsible. This article is not written with the purpose of censuring any person or any institution. It is intended rather as a protest against a situation that exists in many states, both east and west. There seems to be a tacit assumption in many quarters that the ordinary training of the construction engineer fits him to solve all geological problems he may encounter in his work. It is no reflection on engineers, individually or collectively, to state that this assumption is fallacious. Geology is a complex subject. Many of its problems tax all the resources of men who have devoted the best years of their lives to its study. Without question most engineers charged with the building of dams and other large structures would welcome co-operation by competent geologic specialists.

"Disasters always call forth some condemnation of the *status quo* and many suggestions for improvement. In discussions stimulated by the breaking of St. Francis dam the claim has been made that a special study of geology should be required of all civil engineering students. Certainly a course in the fundamental principles of geology, emphasizing the applications to engineering practice, should have an important place in the training of construction engineers. Many schools include such a course in the curricula. It cannot be expected, however, that the student will become proficient as an engineer and as a geologist at the same time. He should of course have some basis for appreciating the nature of geologic problems that may confront him in his work. Such an appreciation will serve to emphasize in his mind the need for co-operation with highly trained geologists.

"Governor Young's commission stresses the desirability of having all such structures as the St. Francis dam 'erected and maintained under the supervision and control of state authorities.' Surely the people of California ought to demand no less than this, because 'while the benefits accrue to the builders

of such projects, the failures bring disaster to others who have no control over the design, construction and maintenance of such works.' Unquestionably, state supervision decreases the danger; but in the writer's opinion a further step is desirable—the participation of geologists in the selection and final approval of dam sites should be specifically provided. Certain states require official inspection of such sites, but commonly the board is made up of engineers only. If the system of state supervision were universal, and if each board of engineers for inspection and approval of dam sites included at least one competent geologist, the danger of disastrous failures would be in large part removed.

"High dams for water supply and for power projects are esssential for present and future development; and doubtless the number of such structures will increase rapidly, especially in certain parts of the West. The recent experience in California furnishes a plain warning that geological conditions at dam sites cannot be ignored. There is reason to believe that California will profit from the lesson. It is the duty of other states also to take any measures that promise to prevent similar disasters within their borders."

Canada's Mineral Resources

THE EDITOR:

Sir—One cannot question the conclusions of Mr. C. M. Campbell (*E & M. J.*, Aug. 4) as to the Pre-Cambrian shield in Canada. What does seem incomprehensible is that any intelligent person could accept without reservation such statements as he quotes, for instance "practically every inch of the 'dead heart' (Pre-Cambrian) of Canada is laden with precious metals." Or that the hyperbolical nature of these statements should require the note of caution. But no doubt the caution is given advisedly. Mr. Campbell's contribution is timely in that he points out the difference between the Pre-Cambrian as a whole and its Huronian constituent.

In 1919 I was one of those who made an examination of Flin Flon and neighboring gold-bearing territory, all in the Huronian, for a group that held Flin Flon under option. At that time there had been no systematic prospecting of that district, and there were known only Mandy, Flin Flon, and several low-grade gold prospects in the Herb and Cranberry lakes areas. Mandy and Flin Flon both had been accidental discoveries. Though I recognized the opportunity presented in the nineteen million tons of copper ore of Flin Flon, it seemed to me that the overwhelming argument in favor of exercising this option was this: Here is an unprospected area of 2,500 square miles of possible mineral-bearing territory in which other important discoveries are likely to result from development of Flin Flon, and the attention drawn thereby to the district, and these discoveries, could mean much to any powerful concern first intrenched therein. I think this view was shared to some extent by those who held the option, but too serious controversy affected the final negotiations.

This Huronian area lay an island in the Pre-Cambrian, the latter stretching far east and north almost uninterruptedly to the very confines of the map. I do not recall that in those days anyone had the audacity to wave the prophetic wand over this vast territory.

DWIGHT E. WOODBRIDGE.

Duluth, Minn.

The Control of Industry

THE EDITOR:

Sir—I read and reread your editorial comment and the article entitled "Two Sets of Brakes for the Mineral Industry," by Dr. George Otis Smith. It is bad enough to have a distinguished Organ of the Mineral Industry, like yours, adopt a growing policy of "Industrial Control," but the utterances, on this subject, of a man of the public standing of Dr. Smith, given such wide distribution, do incalculable harm to the industry and to society in general.

Many times I have been in grave doubt as to the philosophy or desirability of some doctrine advanced as a panacea for economic evils, but in this matter I have no doubt. I know it is wrong, and it ought to be apparent to anyone who has studied economics and sociology and who has given any thought to the history of society and has observed the workings of government.

It so happens that I am a member of the Conservation Sub-Section of the California State Bar and that we have just finished a heated discussion on this Conservation by Co-ordinate Agreement of members of some designated industry. Our sub-section, while probably not yet representative of the thought of that division of the State Bar, agreed that if there was to be control of industries, either to prevent waste or overproduction, it should be by direct control of the people through commissions or other state agencies, and not by agreement among the members of an industry. The sub-section went further and expressed its unwillingness to extend the commission form of government any further than absolutely necessary to protect the absolutely fundamental rights of the people. The question of whether, when an industry had reached a stage where it needed control, it would be by state agencies or whether it would be classed as a public utility, was left for further discussion. This matter has been pretty thoroughly canvassed by thinking men, and the American Bar Association recently made some observations on the subject which I feel sure do not reflect the opinion of the bar in general throughout the nation. There are some pretty big forces and interests working through the utterances and findings of prominent men and organizations, but this does not make them right.

Two definite agencies have been utilized for the extension of the monopoly of the mineral industry by big interests. The one longest used has been the blue-sky laws, which under the guise of preventing fraud, which they do not, have driven the investment of capital into the hands of the investment bankers of the country, thereby making it almost impossible to get capital for beginning enterprises in the mineral field, which has greatly strengthend the monopolies already existing in group form in that industry. Overproduction in these fields was the direct result of the enforced equipment and development due to the war, and the properties demonstrated to be capable of supplying the whole demand now feel that they would like to be protected in their monopoly while their resources last, and by that time they would be in a better position to replace their reserves in new properties than any beginners in the industry. So long as they can convince the public that they are in a better position to supply the demand than the beginner, they can keep new capital out of the industry.

The first objection advanced by the corporation commissioners will be that the demand is now already supplied and that the beginning organization is doomed to failure. There is where the investment bankers have spiked the guns of competitors. The public, however, are beginning to see through the scheme, and to analyze the so-called fraud prevention, and to realize that their rights are being abrograted and their opportunities limited by this practice, and the pendulum will swing back, and this tendency has been noted by the big interests, and they know that this movement cannot be stayed, that in the past the attempt to check reactions of the people, as the result of observation and experience, has only resulted in increasing the force of the reaction.

A new agency had to be found to check or divert these reactions. The Doctrine of Conservation was selected to play the major rôle in economics for the next decade.

The big interests in these mineral industries are said to have grown too fast; they have outstripped the industry. Whose fault is it if the steel trust has overdeveloped or the copper industry is unable to find a market for all it can produce, or the coal industry cannot find people enough to burn all the coal the industry can deliver? Have not these same industries arisen to their exalted positions through the markets developed under a supposedly competitive system? Is not the industrial and commercial supremacy of these United States the result of competition, and have not these gigantic organizations, some of them running into five billions, been practically all developed since the anti-trust laws went into effect? And now these industries want the public to insure them against loss and competition from the outside by suspending the Sherman Anti-Trust Act and other anti-monopolistic safeguards, permitting co-ordinate agreements among members

of the industries, regarding so-called waste, but aimed primarily at the control of production. Control of production means control of price—at least that is the principal value to the industry. The industries put on the soft pedal when you try to link price control with control of production, but control of production at a price level that will yield them a profit commensurate with their risk and investment is the aim of all industry. Now, where does this idea differ from the idea of restraint of trade that has been almost forgotten?

The industries claim they have grown up and therefore can be trusted to work for the public good. What has occurred the past twenty years to indicate that big business in any line has been converted? Not a thing, and everybody knows that the members of an industry would cut each others' throats or overcharge the public today just as readily as they would have done twenty years ago, if they could get away with it. That is natural; we don't and should not expect human nature to show any other quality. But certain powerful groups grown dominant in a field might well want to postpone the clash between themselves for supremacy until favorable conditions develop. The law of supply and demand is there and will be the active principle involved even though you cloak it with any doctrine you please. Ultimately the weaker will fall, and the industry will have to carry the weaker or absorb them, or price levels will have to fall, because, after all, the public is the purchaser of the commodity supplied, and, if it stops buying, all the agreements in the world will not save the industry. That brings us right back to competition as the basic idea in industry. We cannot get away from it.

Every industry and every decade has to take up its own slack. This slack is the product of poor financing, poor judgment, poor administration, unfair policies, weak methods, misfortunes, accidents, and a thousand and one other things. Slack is what gives the beginner a chance. The rise and fall of prices due to overproduction or business depression is what keeps the healthy and necessary checks and balances on industry and weeds out the weak and lets in the new life and keeps the dry rot and decay out of the established members of a group. You might postpone the struggle for supremacy in a group, you might keep weak members alive by artificial stimulants, like the doctrine of conservation, but you cannot stop the inevitable showdown that comes to every industry. What is the advantage of publicly kidding ourselves every so often with sophistries?

Control means paternalism, either public or private—take your choice. I would prefer public control if it had to come, and if an industry has grown to a point where it is unmanageable by the members, where they cannot see the eternal fitness of things and act accordingly, then the public necessity of having the commodity should prompt the public to exercise a control that will keep the industry from becoming a menace to society and yet retain its advantages for all. This can be done by treating it as a public utility. It practically shuts out the beginner, but he can be solaced by the thought that the rate of profit is very low and that there will be no slack to be taken up by the public. Paternalism by control, not paternalism by government ownership, is the lesser of two evils.

Does anyone believe the public utilities have grown up and could be trusted to treat the public properly? If so let us do away with the Interstate Commerce Commission and railroad and rate-making commissions in the states. What would happen? We would be right back to the favored customer basis, the rebate era, discrimination, lack of transportation, and a lot of other evils that we tried to correct by legislation. To try to correct these evils by agreement among members of an industry might help the industry temporarily, but it would be no help to the public, and, after all, if conservation is to be valuable it should protect the public.

We talk about conserving natural resources for future generations and we can trust our big interests to do that for us. If that is true why did the steel trust overdevelop its capacity? It did that, not as a result of inexperience or poor judgment, but to discourage anyone else from entering the field. That's how it can be trusted. The copper industry is another altruistic group. Can you get a dollar for new copper production, even though you can show ore reserves and cheaper production? Try it. You get encouragement but no action.

We boast of equal opportunities for all in this country. If we desire to make that boast good, we must kill this spectre of "Restraint of Trade" in whatever guise it assumes. If we want our sons to have the chance to make a name for themselves, to achieve something in the industrial world, to get away from the salaried job, we must keep a healthy competition in the industries. It may result in loss and slack to some, but it will result in success and profit to others; that gamble, that risk, that opportunity, is our birthright.

To advocate these doctrines of control and conservation is to drive the public to socialism again.

No, let us make our industries keep on their toes or go under, and if they fail others will take their place.

We must see the end from the beginning. We might make mistakes through ignorance, but there is no excuse for it in this much considered field.

Another fallacy commonly indulged in is that cost reduction is a benefit to the public and that waste is harmful. A common-sense analysis of the matter will show that each of these has its compensations. Reducing cost by eliminating waste means reducing the amount of some commodity used, and is finally reflected in price level of that commodity and finally in the labor employed in that industry, which directly affects prosperity all along the line. Reduction of price in a commodity by increased efficiency results in decreased employment or artificial demands being created, which stop in periods of depression, and thus whole industries may be wrecked.

What we want to do is to create healthy conditions in industries by competition: we must strike a balance between all the elements in the picture; an equilibrium is only established through the proper working of the law of supply and demand and the rule of the survival of the fittest.

The real harm to flow from the adoption of the doctrine of control is not in the final balance struck; no matter what method is adopted, the law of survival will be there to check in. It is the elimination of the contestive spirit, denying the right of equal opportunity, discouraging individual initiative, chilling the love of conquest, denying the individual the opportunity for independent achievement, that we deplore. It is our birthright under the Constitution. We should not trade it for Continental doctrine. It has not been outgrown and never can be. It is sacred to the American if he wishes to keep his country and his race supreme.

Los Angeles. E. D. FOSTER.

Tin in Virginia

THE EDITOR:

Sir—I desire to correct some erroneous statements as well as impressions made in Mr. F. Lynwood Garrison's article "The Tin Resources of the United States," published in *Engineering and Mining Journal* of Aug. 11, 1928. He states: "I know nothing about the North Carolina deposits; probably they resemble those of the Cash mine, at Irish Creek, on the eastern slope of the Blue Ridge, in Rockingham County, Va. At this place I think they once had a mill and a small smelter, but never produced any respectable amount of pig tin. The place is famous among mineralogists as yielding beautiful crystals of cassiterite, and has, at various times, been promoted as a mining proposition. I recall once advising a client not to invest any money in it."

This mine, or more properly the Irish Creek tin district, consisting of twelve or more square miles, is situated in the northeastern part of Rockbridge County, Va., on the west slope of the Blue Ridge at an elevation of about 2,800 ft. The operators built a large mill, and it is in perfect condition at the present time. They did not build a smelter. It has been legitimately promoted as a "mining proposition."

In 1889, 2,400 lb. of concentrates containing 43 per cent of tin was shipped. These concentrates were obtained from ore averaging over 3 per cent tin.

Litigation over the title forced the operators to abandon the property, and the long period of idleness is due to the uncertainty of the title to the property rather than the lack of confidence in the value of the deposit.

Geer, Va. MARSHALL HANEY.

THE EDITOR:

Sir—In his comment regarding "The Tin Resources of the United States," in your issue of Aug. 11, 1928, Mr. F. Lynwood Garrison speaks of the Cash mine at Irish Creek as "being on the eastern slope of the Blue Ridge, in Rockingham County, Va." The mine is on the *western* slope, just over the divide, and is in Rock*bridge* County. His observations regarding this deposit are correct.

JAS. LEWIS HOWE.

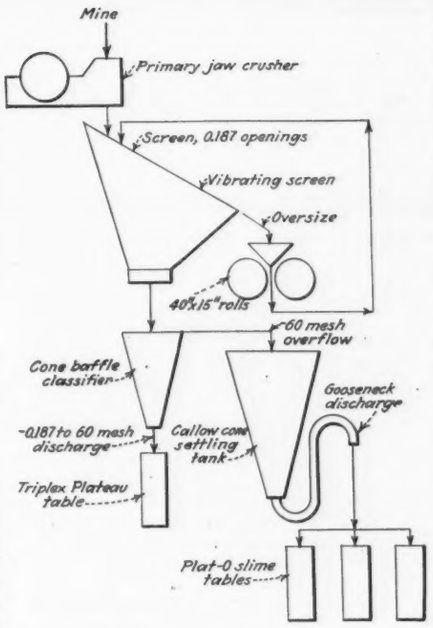
Washington and Lee University, Lexington, Va.

Ore Concentration Prior to Metallurgical Separation

THE EDITOR:

Sir—The editorial in the July 14 issue on the subject "Concentration as an Important Adjunct to Cyanidation" has proved of special interest to me for several reasons. For eighteen years I have been preaching the doctrine of preliminary gravity concentration in connection with both cyanide and flotation plants, stressing the points of the great saving to be obtained in both the cost of fine grinding and the use of reagents. Admitting this to be true, I was confronted with the argument that, due to the comparatively small capacity of a concentrating table, the cost of installation and operation was in most cases prohibitive.

I may possibly be accused of "hiding my light under a bushel," but the facts are that for the last five years there has been manufactured, advertised, and sold an ore-concentrating table with a capacity equal to that of the revolving cylinder concentrators developed through the research of Mr. Johnson. This table, in addition to its large capacity, possesses the advantages of being able to deliver a clean tailing to go to waste, a true middling for regrinding and retreatment, and a clean, high-grade concentrate of all the free mineral, divided into two or more products if desired. It may be possible, but it is difficult to imagine, a revolving cylinder 12 ft. long treating the tonnage stated, and in addition possessing all of the advantages claimed for the table.



Flow sheet for a lead carbonate ore

The introduction of this table into the mill circuit requires no radical departure from current mill practice. The usual recommendation, which can be more readily visualized by reference to the sketch flow sheet shown above, is to crush to as coarse a mesh as possible within the treatment limits of the table, usually a maximum of 4 to 6 mesh, or as much finer as is necessary to unlock the greater portion of the mineral content. The crushed ore is then deslimed in a classifier, the slime going to single plateau slime tables for preliminary concentration, or direct to flotation or cyanide tanks. The deslimed material discharged through the classifier spigot is the feed to the triplex plateau table, the one referred to in a preceding paragraph of this letter.

The accompanying sketch flow sheet is for a lead carbonate ore, and nothing is shown beyond the tables, as that part of the treatment had not been fully decided at the time the tables were furnished.

An outstanding instance of the capacity of the triplex plateau table is the equipment of one section of the Magna mill of Utah Copper with eight of these tables treating 2,000 tons of low-grade copper ore per 24 hours, with satisfactory results.

In addition to reduced operating cost, the problem of attendance is simplified. Real millmen are few and far between. The plateau feature of the triplex plateau deck makes this table practically automatic, thus reducing to a minimum both the quantity and the quality of attention required. In the operation of an installation of 259 of these, in a Michigan copper mill, only one attendant is required per shift.

Another of the features concerning this table is that you can find it treating minus-¼-in. mesh cryolite at Natrona, Pa., and minus-100-mesh ilmenite sand at Pablo Beach, Fla. This is a wide range of sizes for one table, and marks it as of almost universal application in its particular field.

Our friends in South Africa have the proper conception of correct milling practice, but lack information as to machinery which will give them the best results. Here in the Western Hemisphere our milling engineers have at least had the opportunity of informing themselves as to the equipment available, but appear to be woefully deficient in the knowledge of the proper milling methods to pursue. Apparently an interchange of ideas would be of considerable benefit to the industry.

B. J. ROBERTS,
Deister Machine Company.
Fort Wayne, Ind.

New York headquarters of "Engineering and Mining Journal" from the air—McGraw-Hill building within circle.

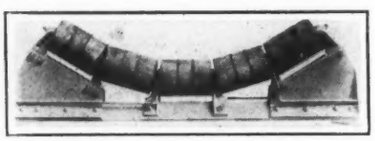
Photo by Airmap Corporation of America

INDUSTRIAL PROGRESS

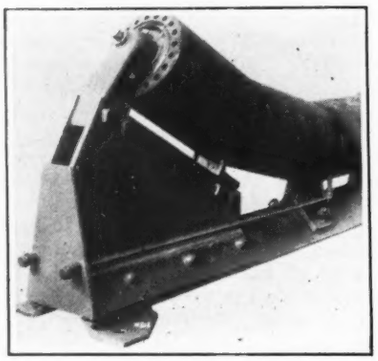
Rubber-covered Pulley Gives Longer Belt Life

A NEW rubber-covered pulley, especially applicable at belt-conveyor loading points, such as under grizzlies, screens, and chutes, has recently been placed on the market by the Robins Conveying Belt Company, of New York. Much longer life for conveyor belts and protection of the pulley against breakage are assured by the device, it is claimed.

Efficient absorption of the impact of falling material discharged on to the conveyor belt is effected by a resilient rubber shell of special compositon. This shell, which is 1 in. thick and pierced by ⅜-in. holes parallel to the axis of the pulley, is permanently cemented to the cast-iron core. The pulley is provided with Timken tapered roller bearings with automatic spring adjustment, large grease reservoirs, and alemite fittings. The unit is of strong construction throughout, the base being made up of structural steel, and the supports of heavy-duty type castings.



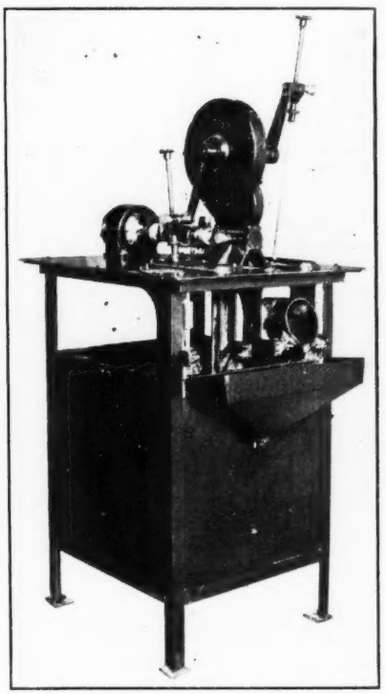
Front view of new rubber-covered belt conveyor pulley



End view, showing rubber shell and rugged construction of the new pulley

Lime Feeder Supplants Hapazard Methods

ANOTHER device, important in control of flotation operations, has recently been placed on the market. This is a lime feeder, designed by J. F. Geary and manufactured by the Galigher Company, of Salt Lake City. The mechanical features of the device are similar to those of the Geary reagent feeder. Two cups, however, are used in the lime feeder instead of one cup, and they assure for the device a much greater capacity than the reagent feeder. A revolving agitator, extending to the bottom of the tank, keeps the suspended solids from settling out, and any solids that may tend to accumulate in the bottom of the cups are displaced by a special valve arrangement, with which the cups are equipped. Discharge of the feeder may be adjusted quickly, and regulated over a wide range, varying from a small fraction of the quantity customarily used up to 8 gal. a minute.



The Geary lime feeder

INDUSTRIAL NOTES

R. B. Randall has been appointed manager of the Pacific Coast division for the crane and shovel department of the Link-Belt Company. Garfield & Co., Hearst Building, San Francisco, have already been appointed exclusive distributors for the company's shovel and crane equipment for northern California and adjacent Nevada territory. The Link-Belt Company opened an office in the Hearst Building, in San Francisco, on Aug. 1. This will handle gas crane and shovel business exclusively.

Fred Johnson has been appointed manager of the Los Angeles branch office of the Wagner Electric Corporation, of St. Louis. Formerly he was in charge of the company's St. Louis sales office.

The Chain Belt Company has begun construction of a new building on its 59-acre tract at 39th and Orchard Sts., Milwaukee. It will be completed by Sept. 15. This will be the sixth building to be erected on the tract.

Four new plants of the Linde Air Products Company, New York, have recently started production of oxygen and are serving their respective localities. These are situated at the following points: 631 South 17th St., Harrisburg, Pa., J. J. Naber in charge; 17th and West Lawrence Sts., Allentown, Pa., W. Barber in charge; Foster and Thomas Sts., Shreveport, La., F. T. Rueger in charge; and First Ave. and B Sts., South Charleston, W. Va., E. Pohlman in charge. Thus the total of the company's oxygen-producing plants in the United States is brought to 52.

The Prest-O-Lite Company, New York, has also recently added two new plants to its chain, bringing the total to 33. These will serve near-by industry with dissolved acetylene used in oxyacetylene welding and cutting. One of these is located at Harrisburg, Pa., at 631 South 17th St. and is in charge of H. A. Smith. The other is at 17th and West Lawrence Sts., Allentown, and is in charge of J. W. Summers.

The Chicago Pneumatic Tool Company has recently completed a new modern foundry at Franklin, Pa., where all gray-iron castings for engines and compressors will be made. Buildings and equipment represent an investment of over $400,000.

Trell W. Yocum, one of the executives of the American Petroleum Institute, has been elected managing director of the Oil Heating Institute and the American Oil Burner Association. Leod D. Becker, who has been at the head of the two organizations since their establishment six years ago, has resigned to devote all his time to his publishing business.

Grant Thorn has resigned as sales manager of the American Cyanamid Company to become associated with the subsidiaries of the International Combustion Engineering Corporation, 200 Madison Ave., New York, which concern is identified with the coal-tar products and allied chemical fields.

NEWS OF THE WEEK

Summary

INTERNATIONAL First-Aid and Mine Rescue Meet was held at Butte, Mont., on Aug. 20-23. Forty-seven first-aid teams from mining districts in eleven states participated. Page 309.

* * *

The largest thickener in the world was recently started at the property of Miami Copper near Globe, Ariz. This piece of equipment has a diameter of 325 ft. and can handle 18,000 tons of material a day. Page 309.

* * *

Between 20,000 and 25,000 tons of equipment will be needed for the construction of the transmission line from the Island Falls power site to the Flin Flon mine of Hudson Bay M. & S. Page 311.

* * *

The output of the four smelters in the Salt Lake Valley showed a decline during the first half of 1928 as compared with 1927. Page 308.

* * *

A decision has finally been made in the long suit over the La Integridad iron ore deposits, in Michoacan. H. C. Sandifer and associates will reorganize the operating company and attempt to develop the ores. Page 312.

* * *

The International Joint Commission will hear the Consolidated Mining & Smelting smelter fumes case this fall. Agriculturists in the State of Washington claim that the fumes from the Trail (B. C.) smelter damage their crops. Page 308.

* * *

The tin situation is not considered unfavorable by the majority of the producers, according to reports from London. E. W. Newton believes that many of the now idle Cornish mines can be worked at a profit with present prices. Page 312.

Anaconda Buys Clark Interests in Montana

Elm Orlu Mine, Timber Butte Mill, and other Butte Holdings of the Late Senator's Heirs Transferred —Price Not Definitely Stated

Special Telegraphic Report
By Carl J. Trauerman

Butte, Mont., Aug. 22, 1928. As a result of the negotiations carried on during the last ninety days, Anaconda Copper Mining Company on Aug. 21 contracted to acquire all the Montana interests of the W. A. Clark estate except Missoula Public Utilities, according to official announcements of C. F. Kelley, president of Anaconda, and Robert E. Tally, president of the Clark-Montana Realty Company. The sale is effected at the instance of 80 per cent of the stockholders of the companies involved. A large part of the stock is held in trust by New York and New Jersey trust companies. Interests sold are the banking business of W. A. Clark & Brother, a co-partnership; the Butte Electric Railway Company; the Moulton Mining Company; the Butte Miner Company, which publishes a daily newspaper; the Montana Hardware Company, a large hardware concern; the Butte, Mont., but not Utah nor Idaho properties of the Clark-Montana Realty Company; the Western Lumber Company; the Elm Orlu Mining Company, important producer of zinc ore at Butte; and the Timber Butte Milling Company, which operates a flotation plant at Butte. The personal interest of W. A. Clark, Jr., in Elm Orlu and Timber Butte properties is included. All the heirs joined in making the sale and the entire title to properties and interests was transferred. The final papers are to be signed today and the physical transfer of the properties will take place today.

Official Statements

Mr. Kelley issued the following statement:

"Metals Bank and Trust Company of Butte is taking over and will conduct the banking business of Clark & Brother. In view of the importance of the transaction, Anaconda believes that by merging the respective operations, the interests acquired can be made not only profitable to it, but also to contribute a more lasting and greater importance to the industrial prosperity of the state than under any other possible arrangement.

"Among the properties conveyed are a large number of undeveloped mining claims favorably situated in the Butte district, upon which active work will be undertaken, in the expectation that by so doing miners will be added to the payroll and the permanence of Butte's mining industry may be more fully assured. The properties were taken over for a cash consideration."

Mr. Tally said:

"For a number of years the Clark estate trustees have been desirous of liquidating the investment in companies involved in the sale, and this spring other heirs of the late Senator Clark joined in insisting that the properties be sold. Anaconda was approached as the most logical purchaser, but Anaconda in no way influenced either the decision of the Clark interests to sell nor their request to Anaconda to negotiate for the properties. The operations of these companies will be continued under the management of Anaconda, and as many of the employees will be retained as is consistent with efficient management. Payroll reductions as a result of the sale will be insignificant, and though this sale from a sentimental standpoint is to be regretted, it was inevitable, and from a practical standpoint may well prove beneficial to the future development of Butte. The most important mines owned by the Clark interests in Montana, the Original and Stewart, were sold to Anaconda some years prior to Mr. Clark's death."

The foregoing are the only official statements, and no price is mentioned. It is believed that the price is not great enough to call for any additional financing by Anaconda, as the treasury of that company will probably take care of the amount. Guesses in Butte range from $6,000,000 to $9,000,000. John D. Ryan, chairman of Anaconda, is now on his way to Montana.

Output of Salt Lake Smelters Shows Decline for First Six Months of 1928

TONNAGE of crude ore and concentrates treated at the smelters in the Salt Lake Valley during the first six months of this year decreased 3.85 per cent compared with the tonnage smelted in the same period of 1927. Production of the four plants declined to an even greater degree, lead bullion being 5.66 per cent less and copper bullion 6.04 per cent below the output of last year.

The quantities of the different metals contained in the lead and copper bullion decreased as follows: lead, 5.63 per cent; copper, 5.95 per cent; silver, 10.25 per cent; and gold, 8.88 per cent.

A consolidation of statistics courteously furnished *Engineering and Mining Journal* by the American Smelting & Refining Company, International Smelting Company, and the U. S. Smelting, Refining & Mining Company shows that during the first half of the current year 965,799 tons of crude ore and concentrates were smelted, from which 81,299 tons of lead bullion and 73,691 tons of copper bullion were produced. This bullion contained 159,671,893 lb. of lead, 145,311,038 lb. of copper, 10,116,118 oz. of silver, and 111,706 oz. of gold. In the same period of last year 1,004,443 tons of ore and concentrates were treated, which yielded 86,177 tons of lead bullion and 78,427 tons of copper bullion, containing 169,193,751 lb. of lead, 154,506,424 lb. of copper, 11,270,999 oz. of silver, and 122,587 oz. of gold.

The Midvale smelter of U. S. Smelting, Refining & Mining near Salt Lake City, Utah

International Nickel Installs Safety Equipment

INTERNATIONAL Nickel has installed at its mine in the Sudbury area of northern Ontario a complete rescue station and breathing equipment, as a safeguard against fire. Immediately following the disaster last February at Hollinger Consolidated, International placed orders for a complete rescue outfit, including 10 sets of oxygen-breathing apparatus and 25 gas masks. Arrangements were made to procure the assistance of experts to train crews in the use of these appliances. G. W. Groves, mining engineer attached to the U. S. Bureau of Mines, was engaged especially for this purpose, and the instruction of crews has been in progress for many weeks. An oxygen-breathing apparatus crew consists of five men. Four such crews have been trained in the upkeep, assembling, and testing of this apparatus for actual use in poisonous fumes. All cage tenders have been instructed in the use of gas masks. When the system is completed, a supply of gas masks will be placed at the top of each shaft, available for instant use in emergency. Several other of the larger mines of Ontario have taken initial steps to install rescue stations, but are waiting the publication of the remainder of the Royal Commission's report on the Hollinger fire, which is expected to contain recommendations in this respect.

Jardine Mining May Increase Capital Stock

Jardine Mining, which operates a gold and arsenic property in Park County, Mont., has posted notice of a special meeting of stockholders to be held on Sept. 10 at the company offices in Jardine, Mont., for the purpose of considering an increase in the capital stock and in the number of directors and to outline a plan of action for the immediate future.

The company was incorporated in 1921 with a capitalization of 2,500,000 shares at $1 par. Its property includes a hydro-electric power plant, 40-stamp gold mill, cyanide plant, and arsenic plant.

Consolidated M. & S. Fumes Case to Be Heard This Fall

By Paul Wooton

Special Washington Correspondent Engineering and Mining Journal

HEARINGS at which each party to the Consolidated Mining & Smelting Company smelter fumes case will have an opportunity to appear will be held by the International Joint Commission this fall. At the offices of the commission it was stated that the exact date of the hearing could not be announced until the wishes of those concerned were learned.

On behalf of the U. S. Department of Agriculture it is stated that its commission, which has made an exhaustive study of the damage, is about ready to report. This commission is composed of Dr. Henry G. Knight, chief of the Bureau of Chemistry and Soils; W. W. Skinner, assistant chief in charge of chemical and technological research; A. G. McCall, chief of soil investigation; and K. F. Kellerman, associate chief, Bureau of Plant Industry.

Formal reference of the problem to the International Joint Commission was announced by the Secretary of State on Aug. 13.

Farmers who are operating in the State of Washington in the vicinity of Trail, British Columbia, allege that they have suffered serious damage to their crops as a result of the fumes from the smelter. Senator Jones, of Washington, took the matter up with the State Department, which in turn has discussed the matter with the British and Canadian governments. As a result it has been decided, pursuant to conditions in the treaty of 1909, to refer the matter to the International Joint Commission to determine:

1. Extent to which property in State of Washington has been damaged by fumes from smelter at Trail, British Columbia.

2. The amount of indemnity which would compensate United States interests in the State of Washington for past damages.

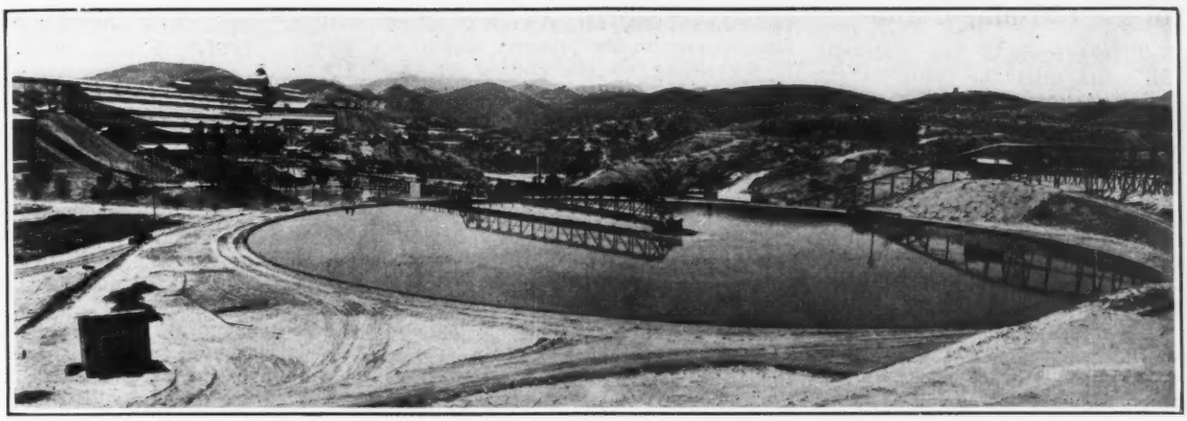
3. Probable effect in Washington of future operations of the smelter.

4. Method of providing adequate indemnity for damages caused by future operations.

5. Any other phase of problem arising from drifting of fumes on which the Commission deems it proper or necessary to report and make recommendations in fairness to all parties concerned.

New Hoist Installed at Hartley Mine

Interstate Zinc & Lead has installed a new hoist, developed at the Rogers Foundry Works, of Joplin, Mo., at its Hartley mine, west of Baxter Springs, Kan. The hoist is operated by a three-cylinder Chicago Pneumatic gas engine, which possesses a rated capacity of 120 hp.



Miami Starts Up Largest Thickener in the World

THE Miami Copper Company, Miami, Ariz., has recently put into operation the large Dorr traction thickener shown in the illustration above. This thickener, although similar to other machines of this type at concentrators in the Southwest, provides more than twice as much area as the largest constructed heretofore.

A settling area of almost two acres is provided by the concrete tank, which has a diameter of 325 ft. With an actual power consumption of slightly over 5 hp., this thickener is now dewatering 10,000 tons of 48-mesh tailing per day, and will soon be handling its designed capacity of 18,000 tons per day, or 12½ tons per minute. On account of the scarcity of water in this district the thickener overflow is pumped back to the mill for reuse in concentrating operations.

The drive carriage of this traction thickener covers a distance of about seven miles in traveling around the periphery of the tank 35 times every 24 hours.

International First-Aid and Mine Rescue Meet Is Held at Butte, Mont.

Eleventh Annual Butte Miners' Safety-First Day Celebrated at Same Time—Combined Program Provides Much of Interest

A SPIRIT of good fellowship and an abundance of hospitality toward all guests characterized the opening of the seventh annual International First-Aid and Mine Rescue Contest held at Butte, Mont., Aug. 20-23, under the auspices of the U. S. Bureau of Mines. Forty-seven first-aid teams and twelve mine rescue teams from mining districts in eleven different states were entered in the contest. The eleventh annual Butte Miners' Safety-First Day was held in conjunction with the contest, and the combined program for the two affairs provided both amusement and much of interest for the large number present.

Following the preliminary examinations of mine rescue crews and apparatus on Monday morning, a crowd of more than 4,000 persons witnessed the beginning of the International First Aid Contest held in the afternoon on the athletic field of Columbia Gardens. Weather conditions could not have been better. Cloudless blue skies prevailed throughout the day, but, although the sun shone continuously, the atmosphere was pleasantly cool. With a background of towering mountains and many of the competing teams clad in white-duck uniforms, the athletic field was an impressive sight while the five problems of the afternoon were being solved. A 7 to 6 baseball game preceding the first-aid contest and a miners' mucking competition afterward provided an outlet for the pent-up enthusiasm of those present.

Concluding problems of the First Aid Contest were worked on Tuesday morning, the ideal weather of the previous day continuing. In the afternoon a special train conveyed about 1,000 of the visitors attending the meet to Anaconda, where they were conducted by guides through the smelting plant of the Anaconda Copper Company. A small copper ingot was presented to each visitor.

Awards in the first-aid contest included: The Hobbins cup, to the first-aid team from the Anaconda Copper Company in Montana scoring highest; the Bauer & Black cup, to the first-aid team from Montana scoring highest; bronze cup presented by the mine managers of Butte to the first-aid team not from Montana scoring highest; the Rocky Mountain Mining Institute cup and six wrist watches to the first-aid team representing Western coal mining companies, organizations, or groups scoring highest. Banners were awarded winning first-aid teams from each state, and to second and third place teams also.

The winning first-aid team received the Congressional bronze medallion, an award by act of Congress, and silver trophies presented by the fifth and ninth districts of the Illinois Coal Operators' Association; also a trophy from the Central District Operators' Association and one from the United Mine Workers of America, represented for the occasion by District No. 12.

Awards for combination first-aid and mine rescue teams included the cup given by the National Safety Council to the team scoring highest; a cup and six small replicas awarded by the Mines Safety Appliances Company; the Joseph A. Holmes challenge cup, presented by the Joseph A. Holmes Safety Association, to the combination team scoring highest; and automobile first-aid kits to the combination teams scoring first, second and third. Banners were also awarded to the three high teams.

Officials of the contest were: Chief judges of first-aid contest, Dr. Harold Schwartz, president, Silver Bow County Medical Association; J. T. Ryan, vice-president and general manager, Mine Safety Appliances Company, Pittsburgh, Pa.; chief judge of mine rescue contest, W. G. Duncan, associate professor of mining extension, Pennsylvania State College, State College, Pa.; chief recorder, Dr. August Knoefel, Terre Haute, Ind.; chief timekeeper, J. Burke Clements, chairman, Montana State Industrial Commission.

Announcement of the winners of the various awards, and an illustrated detailed account of the contest, will appear in the next issue of *Engineering and Mining Journal.*

Bisbee Commemorates Filing of First Mining Claim

ON THE evening of Aug. 2, exactly 51 years after the filing of the first mining claim in the Bisbee district of Arizona, pioneers and residents of the camp united in celebrating the efforts of Jack Dunn and his hardy band in pioneering and locating the first mining claim in the Mule Mountains, which have been productive of so many millions since. Among those present were many who remembered the "good old days," and who related tales of fortunes made and lost overnight—Indian days, boom days, two-gun men, and all the other accessories which go to make a regular Western mining camp.

Bisbee was a lively place at one time; today "it is quiet enough for any man." It has grown up, and is no longer a Wild West camp, but a prosperous mining town, with three producing companies, and two new bonanza orebodies to its credit in the last two years. It is today, as one mining engineer puts it, "Fifty years young."

Development at Malartic Is Encouraging

Diamond drill operations on the Malartic, in the Rouyn area of Quebec, indicate an important extension of the zone of mineralization lying adjacent to a porphyry intrusion south of the formerly developed area. Six diamond drill holes have shown a length of 700 ft. and an average of 30 to 40 ft. in width of ore. Parts of this deposit carry moderately high assays, though the indicated average for the whole deposit is of low to medium grade. This newly explored deposit runs parallel to that formerly developed at the 125 and 250 ft. levels, some distance to the north.

Smoke Suit Litigants Want No Jury Trial

The smoke-damage suits pending in the United States District Court of Arizona against United Verde Copper Company and United Verde Extension Mining Company will be tried by a judge. Defendants and the plaintiffs have signed formal agreements to waive jury trials.

Atlas Exploration Will Develop at Great Slave Lake

Dr. J. Mackintosh Bell, Canadian mining engineer and managing director of Atlas Exploration, of Ottawa, has gone to Great Slave Lake, in the Mackenzie district of Alberta, where he will supervise a program of prospecting and development of the lead-zinc deposits held by the company. The company has one and a half square miles of property along the south shore of Great Slave Lake, about 40 miles southwest of Fort Resolution. In 1921 and 1922, the company did some work on these holdings, and operations were then suspended until this year. A crew of fifteen men is now on the property and work is proceeding on the sinking of two prospecting shafts. The deposits of lead-zinc, which are in limestone, are reported to be extensive, and with a view to determining their value prospecting has been undertaken on an increased scale this year.

Activity Continues in Wisconsin Fields

The James & Mullen Mines at Shullsburg, Wis., owned and operated by the Vinegar Hill Zinc Company, are producing 200 tons of zinc concentrates per day and 15 tons of lead concentrates per week. Kistler & Stevens, owners of the famous Blockhouse Mine, at Platteville, Wis., have struck good ore on the Reilly farm, just to the west of the Blockhouse. This is reported to indicate that their lode connects with the West End, which has produced a large amount of lead and zinc. The Blockhouse mill is the seventh to be erected so far on this "range."

Shaherald Mining Company Has New Amalgamation Plant

The Shaherald Mining Company, of the Kramer Hills district, San Bernardino County, Calif., is installing a 30-ton milling plant, for amalgamation only at present. This is the first sign of production from this district, which was thought promising three years ago.

A large body of low-grade gold ore has been developed on the Herklerath holdings, for which the present mill is a pilot installation. If successful, a large mill will follow, perhaps to include cyanidation. A Herman ball mill and Dodd-Houston amalgamators are being installed. T. R. Luckhardt is in charge of operations.

Sidewinder's New Mill Making Steady Production

THE 50-ton cyanide and flotation mill of the Armstrong Mining Company, erected at the Sidewinder mine, Victorville mining district, San Bernardino County, Calif., went into commission in June, and has been in steady operation. Grinding capacity is of 100 tons per day. The first unit of the cyanide plant includes Dorr thickeners, Devereaux agitators, American disk filter, and the usual precipitation equipment.

Because of the scarcity of water in the district, the supply is being hauled by tank wagon from the Sidewinder well, 5 miles distant. It is hoped later that a supply will be developed either in the mine or in the valley just below. W. B. Armstrong, of New York, is president, and John Burmeister, manager. Baverstock & Payne, of Los Angeles, were in charge of the mill design and erection.

Two Sites Selected for Australian Geophysical Work

BROUGHTON EDGE, who is directing the work on geophysics being undertaken by the British and Commonwealth governments in Australia, has recommended that trials of the electrical and gravimetric methods of testing mineral-bearing ground be started at once. The area selected for the electrical methods is at Jinjera, in New South Wales, near the Lake George district and within a comparatively short distance of Queanbeyan. The department of mines of New South Wales has offered all possible assistance in the work and has placed the necessary facilities at Mr. Edge's disposal. In addition, the state government has undertaken to test Mr. Edge's results by drilling if the indications of the existence of orebodies are sufficiently satisfactory.

The gravimetric work will be begun at Yarram, in Victoria, on an area containing brown-coal deposits. Dr. N. B. Lewis, who is in charge of the torsion balances which will be used, requires an opportunity to give his instruments a thorough preliminary examination under Australian conditions. This area affords just the conditions required.

It is not known how long these two investigations will take, but, in the meantime, Mr. Edge is examining other proposed areas and completing his plans for the time when the full staff will be available.

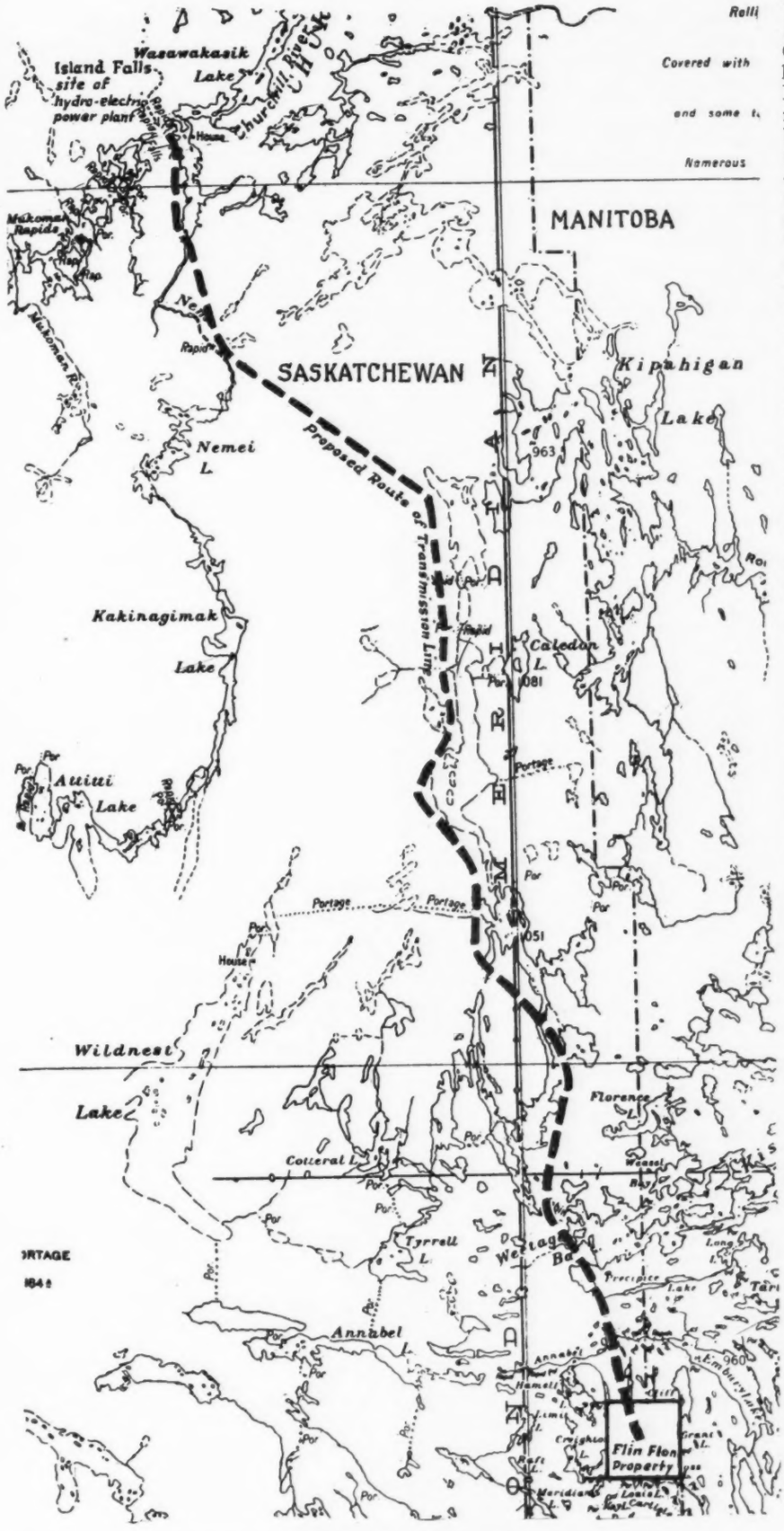
Weak Foundations Endanger Guggenheim Hall

Guggenheim Hall, at the Colorado School of Mines, the most attractive building on the grounds, donated to the school by former United States Senator Simon Guggenheim, recently developed indications that the foundation was weak. Engineers have estimated that about $25,000 will be required to save the building, which cost many times that amount. Mr. Guggenheim has sent his check for $25,000, with the plea to save the building at all costs.

McIntyre-Porcupine Acquires Control of Moffatt Hall

McIntyre-Porcupine Mines has acquired a 58 per cent interest in Moffatt Hall Gold, a property in the Kirkland Lake district of Ontario, pending the approval of the Moffatt Hall stockholders, who will hold a meeting within a week or so. The capitalization of the company will be reorganized. For each two shares of the old stock, the stockholders will be offered one of the new, which, however, will have the same par value as the old. A total of 5,000,000 shares at a par of $1 will be the capitalization. McIntyre-Porcupine, in return for the 2,900,000 shares of stock it will receive, will pay $1,000,000. At present, Moffatt Hall stock sells on the Toronto exchange for 19c.

Aërial Photography Solves Canadian Surveying Problem



Proposed route of transmission line from the Island Falls Site to the Flin Flon mine

PRELIMINARY operations by the Hudson Bay Mining & Smelting Company in the construction of the hydro-electric power plant at Island Falls, on the Churchill River, 80 miles north of the Flin Flon property, have begun, according to a recent statement issued at the Winnipeg offices of the company. A 15-mile summer road to the foot of Mari Lake is being constructed, from which point the route to the site of the plant consists of 60 miles of water travel over a chain of lakes, and 5 miles of portage. Between 20,000 and 25,000 tons of construction supplies and equipment, including 17,000 tons of cement, are to be transported over the route this winter. Heavy shipments will begin in November and continue until April or May.

The initial amount of power to be developed at the plant has not been definitely decided, but it is estimated that 35,000 hp. will be required at the mine. Development of 75,000 hp. is believed possible by utilizing the series of falls at the site. By means of an aërial photographic survey of the area between Island Falls and the Flin Flon property, a proposed route for the transmission line has been determined. This application of aërial photography has enabled the company to solve economically a surveying problem that otherwise would have entailed considerable expense and consumed a great deal of time. With the aid of the maps prepared from the aërial photographs, it is believed that the entire line can be constructed with little or no variation from the route proposed.

Construction of the railroad from Sherman to the Flin Flon mine has been completed to Mile 58, and grading has progressed to Mile 70; this leaves 18.5 miles to be graded at the upper end of the line. Although construction of the road along Schist and Ross lakes may take considerable time, the entire line is expected to be completed in October. Land is being cleared for a new townsite east of the mine, and camp accommodations for 1,500 men will be provided by the time the railroad is finished.

Mining operations at the property necessitate the draining of Flin Flon Lake in the area near the orebody. This will be accomplished either by erecting dams and then pumping out the water behind them, or by driving a 6,000-ft. drain tunnel east to Ross Lake, which is 60 ft. below the level of Flin Flon Lake.

Tri-State Mine Reopened

Metals Exploration, which recently purchased the Mary Ann mine, in the Tri-State district, has reopened the property after practically rebuilding the mill and adding a flotation plant. Equipment in the flotation plant consists of three Butchart machines and an American filter. Output from the mine averaged about 225 tons of lead-zinc ore a day prior to closing down.

Mexico City Letter

By W. L. Vail
Special Correspondent

Decision Is Finally Given in Suit Over Michoacan Iron Ore Deposits

Mexico City, Aug. 11, 1928—The Supreme Court of Mexico is reported to have handed down a decision in a mining suit which has been in the courts for ten years, the action being that of H. C. Sandifer and associates vs. Cia. Mexicano Pacifico de Fierro, most of the stock of which is said to be held in Los Angeles. Judgment was in favor of the Sandifer interests. The suit grew out of differences regarding ownership of 60 hectares of copper denouncements in the State of Michoacan, known for a long time as the Progreso properties, but latterly as La Integridad. According to engineers' reports, the properties contain from 20,000,000 to 30,000,000 tons of an excellent quality of hematite ore assaying 63 per cent metallic iron and lie about 60 miles north of Las Truchas iron properties, owned by the Bethlehem Steel Company, of Pittsburgh, Pa., and about 12 miles from the Pacific Ocean, where plans had been accepted for the construction of piers and cables before the interested parties become involved in litigation. The Bethlehem interests have spent more than 500,000 pesos in diamond drilling on Las Truchas, and their engineers report 60,000,000 tons of ore similar in character to that at La Integridad. The decision is reported to prelude a reorganization of the Sandifer interests and an attempt to open up the Integridad ores.

LEWIS BRADBURY, owner of El Tajo mines, at Rosario, Sinaloa, is equipping his Bolanos properties in the state of Jalisco, near the borders of Zacatecas, with a Diesel power plant, hoisting engines, and air compressors, and is constructing at his own expense a good automobile road to connect the mine with the city of Zacatecas. The Bolanos was another of the old Spanish-worked properties of Colonial days.

The Chihuahua Mining Chamber has presented a very complete memorial to the state legislature setting forth reasons against some of the proposed legislation relative to minimum wages.

The Angustias property, Pachuca, is to be worked on a participation basis by the Real del Monte.

Santa Maria de la Paz, San Luis Potosi, produced 6,430 tons of ore in July.

Operations at La Noria mine, Zacatecas, are reported entirely satisfactory for the first six months of 1928. The plant is handling about 13,000 tons per month. Total value of the monthly production averages $120,000.

The Bote and Vete Grande, Zacatecas, are under operation by the Pittsburgh Vetagrande company, in charge of J. C. Archibald, who has been successfully treating some 24,000 tons per month, mostly dump ores and old fillings. Mr. Archibald's operations have attracted special attention of the mining fraternity because of the fact that he has accomplished remarkable results with the low-grade materials he has been handling. He was for sixteen years connected with the Guanajato Reduction Company, of Guanajato, and is familiar with the treatment of low-grade ores.

The Mexican Corporation, at Fresnillo, Zacatecas, is turning out about 3,000 tons of ore daily and has recently found good-grade ores in the old workings of the mine which are being unwatered. The concern is producing over a ton of silver bullion per month, according to report.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Two New International Nickel Hoists Said to Be the Largest in Canada

Toronto, Aug. 18, 1928.—Two hoists will soon be installed at the Frood mine of International Nickel in the Sudbury district of northern Ontario, which, it is stated, will be the largest ever installed in any Canadian mine. The hoist to be used for raising ore will have a capacity of 10 tons at the rate of 3,000 ft. per minute. It will require 3,200 hp. for operation. About 50 men will be accommodated in the cage hoist at one time. Power for this installation will amount to 1,000 hp.

Good progress is being made in expanding the company's hydro-electric development at Turbine. Contractors in charge of the work are awaiting delivery of the new water wheels and generators to complete the addition. The total capacity of the plant when completed will be about 30,000 hp.

SHIPMENTS to the Noranda smelter have been started from the Waite-Montgomery property, in the Rouyn district of Quebec. Eventually, it is hoped to increase these shipments to about 200 tons of ore a day. Waite-Montgomery ore carries copper and zinc, but the smelter is not equipped to handle the latter. It is said that officials of Noranda are considering the question of handling zinc ores. Waite-Montgomery is controlled by Noranda.

At the Jackson-Manion, at Woman Lake, in the Patricia district of northern Ontario, the crosscut on the 250 level has penetrated the vein for a width of 16 ft. As the width of the vein on the 125 level is 10½ ft., improvement with depth is indicated. The shaft is now down to a depth of 275 ft. Additional equipment for mining operations will be shipped to the property during the coming winter.

London Letter

By W. A. Doman
Special Correspondent

Situation with Regard to Tin Held Not Unfavorable by Most Producers

London, Aug. 7, 1928.—The tin position still causes controversy, as apparently many producers and consumers do not understand the statistics, a matter to which attention has been drawn on previous occasions. The figures as contained in Ricard & Freiwald's circular—and Ricard & Freiwald are the recognized authority—may be summarized thus:

	July 31, 1928 Tons	July 31, 1927 Tons
Total visible supply..	18,073	15,085
Month's supplies	11,500	9,686
Month's deliveries...	9,882	9,984
Price per ton.....	£214 5s.	£292 5s.

This statement does not show stocks in the possession of producers and manufacturers. The belief current some time ago that consumption was ahead of demand is disproved. Disagreement as to what price for the metal would be fair and profitable continues, one interest contending that satisfactory profits can be made at current figures, though others wish to see them higher. Nigerian producers stand for higher prices on account of their heavy working costs; the leading Malayan companies, while not above seeing an improved level, are nevertheless able to earn a substantial rate of return at present.

EVEN the Cornish mining authorities do not regard the present price of tin as unfavorable; some of the leaders, in fact, are quite happy over the existing state of affairs. The duchy is so rich in minerals that a paper read recently in Cornwall by E. W. Newton has stimulated interest in its possibilities more perhaps than anything else for many years. Mr. Newton states that with the present high price of tin there will be renewed activity in Cornish mining in the near future. He would like to see attention paid to some of the numerous shallow mines, most of which were closed when the price of tin was only about one-fourth of today's level. These properties, in his opinion, should prove more remunerative than the deeper areas, where large sums of money have to be expended before profits are earned.

Not all the Nigerian boards of directors are despondent. Speaking at the meeting of shareholders of Ropp Tin last week, Sir Edmund Davis said that the company's steam plant is being worked now that Nigerian coal is available, and costs are expected to be reduced by £5 a ton, assuming an output of 1,000 tons yearly, which will allow a profit to be made with tin at "a considerably lower price than it is at present."

BOOK REVIEWS

THE ENGINEERING INDEX, 1927. Published by American Society of Mechanical Engineers, 29 West 39th St., New York. Pages, 898. Price, $8.50 ($7.50 to A. S. M. E. members).

WITHOUT an index such as this the greater part of the wealth of technical information published annually through the world would be lost to those who need it most. One would like to run through every periodical that touches on his field and make notes of interesting things that he is likely to require. Unfortunately, he can't—he has not time, and, besides, except for one or two, the periodicals are not available. But a skillful indexer can do this for him, and does do it in the Engineering Index at a cost insignificant in comparison with the value of the service.

A reference, however, to a needed article is not sufficient. It remains to obtain the article. Here again the Engineering Index is ready to do what the average person would find impracticable. For a nominal sum it will furnish him with a photostat reproduction of any article wanted. The book as well as the service that goes with it is really something that the busy engineer should turn to his advantage.

BLASTERS' HANDBOOK. E. I. du Pont de Nemours & Company, Wilmington, Del. Comprises 215 pages.

THE fifth edition of this interesting and valuable little volume has just appeared. It sounds like an advertisement to say that no blaster should be without it, but it is nevertheless true. The miner who has been loading his holes by rule of thumb, or using as much powder as lax supervision will permit, could learn considerable from its pages, if they were brought to his attention. Illustrations are numerous and excellent, demonstrating clearly, for instance, how to operate a blasting machine or how to insert a primer in a cartridge. The superintendent also will find it valuable in checking up the blasting practice of his foreman.

A NEW monthly periodical made its bow in July. This is the "Bureau of Standards Journal of Research," in which will be continued the publication of the two series of research papers heretofore issued by the Bureau of Standards at Washington. The two series have been known respectively as "Scientific Papers" and "Technologic Papers." In all, 44 volumes (22 of each of the superseded series) have been published up to the present. The new journal will contain the Bureau's research papers and critical reviews in the fields of science and technology.

HOISTING ORE AT THE CITY DEEP—The practice of hoisting ore in skips, in rectangular shafts, has been considered standard on the Rand until recently, according to a writer in the *South African Mining and Engineering Journal* of June 30, 1928. Two-stage hoisting in circular shafts, as recently introduced at the City Deep mine, has presented special problems. The two shafts used for hoisting the ore 7,000 ft. from the bottom of the mine to the surface are only 50 ft. 5½ in. apart, horizontally, between their center lines. At the top of the sub-vertical shaft, which is at the 4,000-ft. point below the surface, a transfer station has been provided. Here the cars hoisted up the sub-vertical shaft from the 7,000-ft. elevation are transferred to the shaft through which they finally reach the surface. The transfer is effected by means of a shuttle transporter. The latter carries the full car from the lower to the upper shaft; also, the empties in the reverse direction. It is operated electrically.

An excavation was required to accommodate the underground hoist for the shaft reaching from the 4,000 ft. level to the 7,000 ft. point, and the position of a bin of large capacity close at hand would have been difficult to arrange with safety. However, by eliminating the bin excavation and reducing the excavations at the transfer station as much as possible, it has been possible, by free use of reinforced concrete, to accommodate a large Ward Leonard hoist in an excavation approximately 4,000 ft. below the surface. As a result, 8-ton cars, each 13 ft. 3 in. long over-all, are to be loaded at the bottom level, 7,000 ft. below the surface, and finally delivered to the tipple over the grizzlies at the bins on the surface, where the contents will be disturbed for the first time. At all points where the cars are moved on or off the cages, air-operated pushers are employed, and mechanical brakes and stops are provided accurately to locate each car before and after moving.

GEOPHYSICS—*Economic Geology* for August contains an article entitled "Geophysical Methods Applied to Exploration and Geologic Mapping." The authors are T. M. Broderick and C. D. Hohl. This paper is part of a discussion by the authors which was released for publication to the U. S. Geological Survey by the president of the Calumet & Hecla company, and presented before the Society of Economic Geologists at Cleveland last December. In it, the authors discuss, among other topics, the direct and indirect application of geophysics to copper finding.

NOVA SCOTIA—The "Report on the Mines" of the Province of Nova Scotia for 1927 has been received. It consists of two parts, the two making 760 pages. Besides the reports of the various deputy inspectors, Part 1 contains a paper on slate and one on silica, both by K. C. Messervey. Other chapters are devoted to describing the mineral production of the province, presenting statistics on gold and other minerals and their quarries. Part 2 is entitled "An Economic Survey of Some of the Nova Scotia Gold Deposits." Sir Stopford Brunton is the author.

OJUELA TUNNEL—The August issue of the *Compressed Air Magazine* contains a short article describing the work of driving the Ojuela drainage tunnel, which was accomplished by the Peñoles company at its Ojuela unit, in Durango. The tunnel is 5,200 ft. long and 9x8 ft. in cross-section. It was driven in a little more than eight months. The authors of the article are F. E. Bruhn and F. P. Cleary.

TANGANYIKA GEOLOGY—E. O. Teale, director of the Geological Survey of Tanganyika Territory, describes the geology and mineral resources of that part of Africa in *The Mining Magazine* for July. The article is to be concluded in the August issue.

Government Publications

Among the bulletins recently issued by the Bureau of Mines at Washington are the following:

"Crushing and Grinding Studies of Quartz," Reports of Investigations Serial No. 2880. By John Gross and S. R. Zimmerley. The investigation discussed in this paper was undertaken to obtain fundamental data on crushing and grinding and has been confined to work on quartz, up to the time that this paper was written. Ten pages.

"How Fires Start in Mines." Information Circular No. 6076. By K. L. Marshall. The author expresses his opinion that if figures could be compiled showing the total number of mine fires that occur annually in the United States they would stagger even men well informed in mining. The Bureau's statistics on fires are limited to those that have led to loss of life and to disasters. In concluding the author says: "Most of the answers to the problems of fire prevention are self-evident. However, it may be well for every operator to request of his organization a concrete and effective answer to the question 'How to Prevent Fires in Our Mines.'"

"Cyanide Extraction of Gold and Silver Associated With Arsenic and Antimony in Ores, with especial reference to those in Nevada and South Dakota." Technical Paper 423. By Edmund S. Leaver and Jesse A. Wolf. Comprises 52 pages. Price 15 cents.*

"Accidents at Metallurgical Works in the United States During the Calendar Year 1926." Technical Paper 430. By William W. Adams. The paper contains 38 pages. Price 10 cents.*

The chapter on the topic of "Gold, Silver, Copper, Lead and Zinc in Idaho and Washington in 1926," which will form part of "Mineral Resources of the United States, 1926—Part I," has been published in advance. The paper contains 56 pages. Price 10 cents.*

*Sold only by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

Personal Notes

Dr. KUNO B. HEBERLEIN left New York for London on the "Mauretania" on Aug. 16.

T. A. RICKARD is in Victoria, B. C., and will return to California about the middle of September.

W. A. SIMPKINS, mining engineer of San Francisco, has returned from a mine examination trip to Idaho.

SYDNEY H. BALL, of Rogers, Mayer & Ball, left New York on Aug. 17 for a month's professional trip to Colorado.

CLAUDE COMPTON, of Warren, Ariz., chief chemist of the Copper Queen branch of Phelps Dodge, is in southern California.

JAMES F. MCCARTHY, president of Hecla Mining Company, was in New York recently. He spent a few days in Washington before coming to New York.

P. G. BECKETT, general manager of the Phelps Dodge Corporation, will leave Arizona for Canada on Sept. 7, returning, via New York, late in that month.

J. F. ROBERTSON, smelter manager, Mond Nickel Company, Coniston, Ontario, inspected smelting and milling plants in the Salt Lake Valley district last week.

G. W. CRANE, consulting mining engineer, of Salt Lake City, returned to his headquarters there on Aug. 13 from a three weeks' business trip to New York and Washington, D. C.

RAYMOND SPILSBURY, smelter superintendent for the Cerro de Pasco Copper Corporation, Oroya, Peru, has been in the Salt Lake Valley district making a study of metallurgical methods employed there.

Major Sir THOMAS CULLINAN, D.S.O., of Johannesburg, South Africa, the discoverer of the Premier Diamond mine, and interested in many South African mining enterprises, is making a tour of Canada, accompanied by his wife.

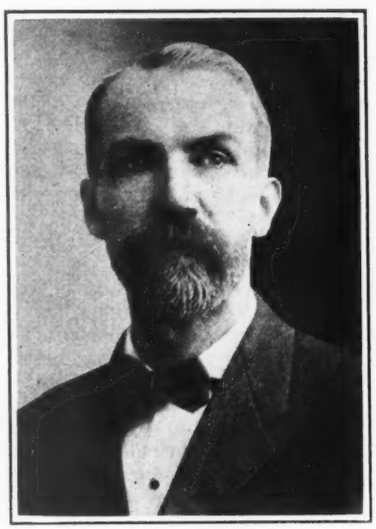
F. K. MIDDLETON HUNTER, mining engineer, who recently returned to the United States from Chuquicamata, Chile, is at present engaged in mine examinations which will take him into Canada for the next two months.

B. M. BIRD, supervising engineer of the U. S. Bureau of Mines, and until recently superintendent of the Northwest Station of the bureau, at Seattle, has been transferred to the Southern Station, at Tuscaloosa, Ala., where he will soon assume his duties as superintendent of the station.

H. A. BUEHLER, state geologist of Missouri, and CHARLES E. SCHWARZ, mining engineer, as consultants of the National Lead Company, are inspecting the Triumph mine, near Hailey, Idaho, and the properties of the Combined Metals Reduction Company at Bauer, Utah, and Pioche, Nev.

H. B. LUMSDEN, assistant director of development for the Canadian Pacific Railway Company, is in British Columbia, making arrangements for a survey of the non-metallic mineral resources of western Canada. Through the instrumentality of the railway's development department a large deposit of high-grade talc is being developed near the British Columbia-Alberta boundary, 24 miles southwest of Banff.

N. F. KOEPEL, of the Andes Copper Mining Company, Portrerillos, Chile, recently visited metallurgical plants in the Salt Lake Valley. Following a trip to Inspiration, Ariz., Mr. Koepel will return to New York, whence he will sail for Chile. T. L. WRIGHT, metallurgist, of the Cerro de Pasco Copper Corporation, Oroya, Peru, has also just completed a visit to the metallurgical plants in the Salt Lake Valley and the Butte district.



GEORGE R. HANCOCK

Dr. HENRY MACE PAYNE, consulting engineer and Director of the Bureau of Mining Economics of the American Mining Congress, delivered by invitation at a meeting of the Kiwanis Club at Evansville, Ind., on Aug. 23, an address on "Brains and Business." Dr. Payne, who has had a wide experience in mining engineering in the United States and foreign countries, is a frequent speaker on economics for similar organizations in various parts of the country.

OBITUARY

JOHN NELSON, retired mine operator, of Cripple Creek, Colo., died in Denver on Aug. 7. Mr. Nelson was 67 years old.

ANDREW MACKIE NIVEN died recently at Johannesburg, aged 73. He was a pioneer, an old and highly respected member of the Stock Exchange, and a director of numerous gold mines and collieries.

V. S. DWELLY, for some years superintendent of the Buena Tierra mine, in Santa Eulalia, Chihuahua, Mexico, died recently in San Diego, Calif., where he had gone in search of health. He had been incapacitated since 1924.

GEORGE R. HANCOCK, for many years prominent in the mining industry of Utah, died at his home in Salt Lake City on Aug. 2, following a short illness. He was 74 years old, and had retired from active business fifteen years ago. Mr. Hancock was born Feb. 24, 1854, at Winchester, Tenn. After engaging in the lumber business for several years in Michigan, he went to Utah in 1890, and soon became interested in the development of the mineral resources of the state. He served in an official capacity with the Daly West Mining Company, Gold Hill Mining Company, and the White Knob Copper Company. In association with Col. William M. Ferry, he developed the Quincy mine at Park City. Mr. Hancock was survived by his widow and a daughter.

EUGENE AUGUSTUS HOFFMAN TAYS died at Trulock, Calif., on July 22 last, while receiving medical treatment for cancer in a sanitarium at that place. He was born at West Point, N. Y., on Oct. 24, 1861, while his father was civilian instructor at the Academy. Mr. Tays attended schools in Kentucky, and Burlington, N. J., and also Union College at Schenectady, N. Y., where he graduated in 1884 as a civil engineer. He was with the Mexican Central Railroad for a time, then joined Albert K. Owen and Arthur Stillwell in laying the route of what is now the Kansas City, Mexico and Orient Railroad. From then on (1885) he made Sinaloa, Mexico, his home, operating first as a civil engineer and then as a mining engineer. For several years he was manager of the San José de Gracia mines, in Sinaloa; also in Chinipas and at the Maconi Silver mines, of Queretaro. From 1907-10 his mining operations were mostly in the Western United States and British Columbia. During the Mexican revolutions he took up ranching and raising tomatoes, alfalfa, and other produce. In 1920 he organized the Liga Agricola, a non-profit, co-operative marketing association for the distribution of Mexican tomatoes and other winter vegetables, whose principal office is Nogales, Ariz. He was general manager of this organization until the time of his death. He is survived by his wife, Rosaura Veda de Tays, four sons, Alexander, Eugene, George, and Clement, and two daughters, Mrs. Lambert, now living at Suva, Fiji Islands, and Mrs. W. E. Dunn, of Leonia, N. J. Mr. Tays' remains were interred in San Blas, Sinaloa, Mexico, his home. He had been a member of the A.I.M.E. for more than thirty years.

MARKET AND FINANCIAL NEWS

Dividends Reflect Copper Improvement

Previous August Record Exceeded by $3,000,000—Kennecott, Tennessee, and International Nickel Announce Increases

By Homar L. Johnson
Assistant Editor

IMPROVED conditions among the copper producers is a major factor in advancing the monthly rate of dividend disbursements by American mining companies for August to a new high record. The probability that this situation will be sustained is indicated by the announcement, last week, that Kennecott, International Nickel, and Tennessee Copper & Chemical had increased their annual dividend rates from $5 for Kennecott, $2 for International Nickel, and 50c. for Tennessee Copper to $6, $3, and $1 per share, respectively. These increases will appear, as actual disbursements, in September and October. Additional dividend increases and resumptions by other copper producers are predicted by various financial authorities, in the near future, and in several instances already have been discounted, several times over, by the investing public in forcing appreciation of share quotations.

Dividend distributions for the second month of each of the last seven quarters are indicated in the following table:

	1927	1928
February	$16,137,913	$17,797,953
May	16,564,931	17,359,998
August	16,965,732	19,866,629
November	17,846,584	.....
Average	$16,878,890	$18,341,527

The dividend total for August, 1928, it will be observed, shows a marked advance over that of any corresponding quarter month during the interval under consideration.

The copper group contribution to the August dividend increase consists of an addition of approximately $1,000,000 by Anaconda and Cerro de Pasco. Utah-Apex, producer of copper as well as silver, lead, and zinc, from its property in Bingham Canyon, posted a 25c. per share payment on Aug. 1. This distribution, the first in two years, is drawn from the company's cash reserve fund, rather than from any increase in earnings resulting from the higher copper price.

Other dividend improvements that aid in swelling the total for the month are the increase in Teck-Hughes' semi-annual payment by $713,574, or 15c. per share, and the addition to the list of Lone Pine-Surprise Consolidated, operating in the Eureka district at Republic, Ferry County, Wash.

The only absentee from the list of regular payers expected this month is California Rand, from which no word has been received. This is somewhat surprising, coming as it does in the face of the recent improvement in the price of silver. Wright-Hargreaves' quarterly distribution is reduced from 5 to 2½c. per share, presumably because of a large increase in mining costs. Lucky Tiger-Combination returns to its regular 5c. per share basis this month, following a practice, of several months' duration, of adding an extra distribution to the regular payment. Included in this month's total for Lucky Tiger is the July dividend of 5c. regular and 2c. extra per share, notice of which was received too late for publication in the July compilation.

Among the company dividends paid in foreign currencies, and consequently not included in the monthly total in United States currency, Aramayo, the Bolivian tin and bismuth producer, is absent, apparently owing to a reduction in its operating income by the prevailing low prices for its metal products. Mond Nickel, an irregular payer of dividends, reports a disbursement of 20 per cent or 4s. per share this month. Otherwise the list is a model of uniformity.

E.&M.J. Compilation of Mining Dividends and Yields for August, 1928

Companies in the United States	Situation	Per Share	Total	Per Cent Annual Yield
American Smelting & Refining	Various	$2.00 Q	$1,219,960	4.0
Anaconda Copper, c, z, l, s	Various	1.00 Q	3,000,000	4.9j
Bunker Hill & Sullivan, l, s	Idaho	0.75 MX	245,250	7.2
Colorado Fuel & Iron, pfd	Various	2.00 Q	40,000	....
Freeport Texas, su	Texas	1.75 QX	1,277,127	10.6j
Homestake Mining, g	S. D.	0.50 M	125,580	8.3
Lone Pine-Surprise Cons., g, s	Wash.	0.01 SA	31,260	....
Miami Copper	Ariz.	0.375 Q	280,168	7.3
National Lead, pfd. "B" l	Various	1.50 Q	375,000	4.9
New Cornelia Copper	Ariz.	0.50 Q	900,000	7.3
New Jersey Zinc	Various	2.00 Q	981,632	5.4j
U. S. Steel, pfd	Various	1.75 Q	6,305,497	5.0
United Verde Extension, c	Ariz.	0.50 Q	525,000	13.5
Utah Apex, c, s, l, z	Utah	0.25 K	132,050	....
Vanadium Corporation	Various	0.75 Q	283,775	4.2
Companies in other countries				
Amparo Mining, g, s	Jalisco	0.01 Q	20,000	....
Cerro de Pasco, c, s	Peru	1.25 Q	1,403,553	5.6j
Granby Consolidated, c	B. C.	1.00 Q	444,605	3.8j
Hollinger Consolidated Gold	Ont.	0.10 FW	492,000	14.1
International Nickel, pfd., n., c	Ont., W. Va.	1.50 Q	133,689	5.2
Lucky Tiger-Combination, g, s	Sonora	0.12 MJ	85,840	10.9
Mond Nickel, c, n	Ont.	4s.	£180,000	....
Teck-Hughes, g	Ont.	0.30 SAX	1,427,143	5.0j
Wright-Hargreaves (new), g	Ont.	0.025 Q	137,500	5.4j
Total			$19,866,629	

c, copper; z, zinc; l, lead; s, silver; g, gold; n, nickel; su, sulphur; Q, quarterly; K, irregular; SA, semi-annual; M, monthly, MX, 25c. monthly and 50c. extra; MJ, includes 7c. per share, regular and extra, paid in June; QX, $1 regular and $0.75 extra; FW, four weeks; SAX, 10c. regular and 20c. extra; j, based on dividends for the last 12 months.

STATISTICAL NOTES

Ahumada Lead Company reports gross receipts of $509,979 for the first six months of 1928. After deducting depreciation, taxes and all other expenses the company reported a net loss of $76,298.

Gladstone Mountain Mining Company, of Spokane, Wash., reports that it has leased its mining property at Leadpoint, Wash., on a 15 per cent royalty basis for two years. Company has several mining properties under consideration and expects to develop some other meritorious property, under company operation, in the near future.

International Nickel Company, Ltd., reports net operating income of $3,575,131 for the second quarter of 1928, compared with $2,590,796 for the preceding quarter. Net operating income for the first six months of 1928 totaled $6,165,927, against $3,657,157 for the corresponding period of the previous year.

Chief Consolidated Mining Company reports gross operating income for the first half of 1928 as $957,508, with operating costs at $863,713 for the period. The quarterly dividend, usually paid Aug. 1, was passed because earnings for the second quarter were inadequate, according to the statement of President Walter Fitch in the semi-annual report of the company recently issued.

Survey of World Zinc Conditions

By International Metal Service, London

Foreign Correspondent of the American Zinc Institute

WEEK AFTER WEEK the public press sums up the zinc markets in Europe as lifeless. Perhaps from a speculative point of view this expression on the market fits the bill, but, if the zinc industry be viewed from the angle of production and consumption, what then? A picture in marked contrast to Metal Exchange stagnation can be shown. For example, world production for the first half of this year of 708,000 metric tons is the greatest ever recorded; and, as stocks at the end of June were not substantially different from the total reported at the beginning of January, it follows that world consumption of zinc is higher than it ever was in war or peace time.

It is probably a reflection on this state of affairs that has inspired talk on the Continent of a revolt against the London Metal Exchange quotation being accepted as the true price for slab zinc. The real trouble with the London market can be summed up in a very few words: selling on the Metal Exchange is out of proportion to the volume of buying, [for consumption] because producers and consumers alike utilize the exchange for hedging purposes, whereas the bulk of metal produced today is sold by producers direct to consumers and traders and thus does not figure in Metal Exchange business. In the last year or two this direct business between smelter and consumer and/or merchant has expanded and tended to accentuate the disproportion between buying and selling orders booked by London Metal Exchange brokers.

One of the leading interests intends to introduce this question for discussion by members of the international cartel in the event of that association being prolonged beyond its probationary period, and, failing the carrying of a proposal that the cartel should be vested with authority to itself exercise discretionary powers over the London selling price, the proposer will submit an amendment that the chief producers shall act in concert by agreeing upon a common selling price for slab zinc week by week, regardless of London Metal Exchange quotations. How the withdrawal of actual metal for delivery against sales made on the Metal Exchange would affect the situation it is difficult to foresee. This particular producer may even be viewing the question from an angle which is perforce not available to other smelters, because it owns its own mines and is independent of purchased ores. Others will probably not be prepared to run the risk of foregoing the advantage of hedging against ore purchases which the London Metal Exchange offers. No other media are open for such hedging. It is all very well to argue that the producers' selling price could always be maintained at a higher level than the Metal Exchange quotation, but this is illogical and it does not follow that in times of speculative activity the average of the Metal Exchange quotation in monthly periods would be definitely higher or lower than the average of the four weekly price fixations of producers. It could, indeed, happen that a smelter would be sometimes paying more for the zinc content of an ore than he would receive for the resultant metal.

The more serious consideration that is bestowed on this problem, the clearer it becomes that there can be no revolutionary change in the selling price of slab zinc in Europe unless there be a corresponding diversion in the method of buying and selling of zinc ores. For the present, at any rate, the London Metal Exchange is the only medium that meets the metal branch of the ore trades in the expression of current prices. If the principal producing interests are dissatisfied with such expression of value, then it is incumbent on them to create a *modus operandi* whereby they can, whenever necessary, either by market support or otherwise, prevent artificiality in the quotation and insure that the London Metal Exchange price shall as nearly as possible represent the true economic value of the metal.

Our estimate of world stocks of zinc as on Aug. 1, 1928, is as follows:

	Metric Tons
United States	38,300
Canada	4,200
Germany-Poland	6,100
Belgium	4,800
France	1,200
Great Britain	1,200
Scandinavia	200
Other Europe	600
Australia	3,600
Far East	800
Elsewhere	2,000
	63,000

MEXICAN REVENUES FROM TAXES on metal production for the first six months of the current year increased, according to statistics given out by the Metals Section, Bureau of Special Taxes, of the Department of Finance. The collections are reported as follows (in Mexican gold pesos):

January	1,276,772
February	1,389,765
March	1,564,281
April	1,459,625
May	981,966
June	1,047,234

Estimating taxes for the remaining six months of the year on the same basis, they will exceed the return for last year by 96,861 pesos.

Nevada Consolidated Net Income Increased 50 Per Cent

NEVADA Consolidated Copper Company, as a result of its operations in Nevada, Arizona and New Mexico for the second quarter of 1928, earned $3,440,337, compared with $2,278,061 in the preceding quarter. This is an increase of 50 per cent.

Production of copper from all sources for the second quarter, compared with that for the first quarter of 1928, is shown in the following tabulation:

1928	Pounds Copper Produced	Average Monthly Production
Second quarter	63,707,374	21,235,791
First quarter	52,576,896	17,525,632

Increased copper output for the quarter was due in large measure to heavy withdrawals from plant inventories of ores and concentrates to meet an urgent demand for copper in marketable form.

Company ores milled and smelted during the quarter totaled 2,814,090 tons, of which 2,793,498 tons was concentrating ore, averaging 1.33 per cent copper, and 20,592 tons was direct-smelting ore. Average recovery of copper in the form of concentrates from company material milled during the period was 87.07 per cent, compared with 86.94 per cent for the previous quarter.

The net cost per pound of copper produced, after crediting revenue from gold and silver and other miscellaneous earnings and income from subsidiaries, was 8.48c., compared with 9.01c. for the first quarter of the year. These costs include all operating and general charges except depreciation and reserve for Federal taxes.

Financial results of the quarter's operations, compared with those for the preceding quarter, are shown in the accompanying tabulation:

	Second Quarter 1928	First Quarter 1928
Operating profit from copper production	$3,214,654	$2,180,654
Value of precious metals	333,233	266,127
Miscellaneous revenues, including income from subsidiaries	312,710	251,539
Total operating income	$3,860,598	$2,698,322
Depreciation	420,260	420,260
Net income	$3,440,337	$2,278,061

Conference of Lead Producers In London in September

PROBLEMS of the lead-mining industry of the world will be discussed at a meeting to be held in London about the middle of September. Prime movers in the plan are British interests, but it is understood on good authority that representatives of the principal American mining interests will be present, possibly in the capacity of "unofficial observers" rather than as active participants. Doubtless the attitude of these interests will play an important part in the proceedings. The matters discussed will be principally the economic phases of production and consumption.

Press dispatches from abroad state that producers generally are of the opinion that the world has not been able to comfortably absorb the production attained in recent years. Prices have declined as a result, and though the fall has not been sufficient to put any important producing interest out of business, the need for some action to prevent any such eventuality is recognized.

The Market Report

Lead Buying Exceptionally Heavy—Other Metals Steady

New York, Aug. 22, 1928—Lead took the spotlight in the non-ferrous metal markets during the week ending today. Not for many months has the aggregate volume of sales been so good; although prices are as yet unchanged, some improvement in the near future would be no surprise. Copper has quieted down, both here and abroad, but quotations are unchanged. The volume of zinc sales was better than average, and a tendency toward higher prices is to be noted. Consumers, as well as dealers, bought tin during the week, attracted by a small decline in price level. Silver is steady and unchanged. Quicksilver and antimony have a buoyant tendency. Arsenic is active at unchanged prices, and the demand for cadmium is strong, with the price somewhat stiffer.

Daily Prices of Metals

Aug.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
16	14.525	48.375	6.20	6.00@6.05	6.25
17	14.525	48.375	6.20	6.00	6.25
18	14.525	48.375	6.20	6.00	6.25
20	14.525	47.875	6.20	6.00@6.025	6.25
21	14.525	47.625	6.20	6.00	6.25
22	14.50@14.55	48.00	6.20	6.00@6.05	6.25@6.30
	14.525	48.104	6.200	6.010	6.254

Average prices for calendar week ending August 18, 1928, are: Copper, 14.529; Straits tin, 48.292; N. Y. lead, 6.200; St. Louis lead, 6.002; zinc, 6.250; and silver, 59.000.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis: that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Aug.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
16	62 7/16	62 15/16	68 3/4	214	209 7/8	22	21 7/8	24 11/16	24 7/8
17	62 3/8	62 7/16	68 3/4	215 3/4	211	21 15/16	21 13/16	24 5/8	24 3/4
20	62 7/16	62 7/16	68 3/4	212 1/2	208	21 11/16	21 9/16	24 1/4	24 9/16
21	62 3/8	62 13/16	68 3/4	211 7/8	207 3/4	21 5/8	21 9/16	24 7/16	24 9/16
22	62 3/8	62 13/16	68 3/4	211 1/2	208	21 7/8	21 13/16	24 5/16	24 1/2

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver		Gold London	Aug.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
16	4.84 7/8	59 1/8	27 3/16	84s11 d	20	4.84 15/16	59	27 3/16	84s11 1/2d
17	4.85	59 1/8	27 3/16	84s11 1/2d	21	4.84 7/8	58 7/8	27 1/8	84s11 1/2d
18	4.85	59	27 1/8	.....	22	4.84 7/8	59	27 3/16	84s11 1/2d
					Avg.		59.021		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pense per troy ounce of sterling silver, 925 fine. Sterling quoations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Copper Quiet and Steady

Total sales of copper during the week are only a little more than half those of the preceding week in the domestic market. Foreign sales also have been slim, although London cables today indicated improved activity. Such buying as took place was mostly for September, with a smaller quantity for October. As producers see the picture, consumers, noting the "stabilization" of the market, are inclined to feel sure that they can obtain metal at figures little if any higher than the current quotations, as they need it, and accordingly are not buying ahead. Comparatively little has been bought for October, and September needs are by no means provided for. Somewhat the same situation obtains abroad, and a considerable acceleration in buying is likely to develop at any time. Deliveries are going along at a good rate, and sellers generally are in a comfortable position. In Connecticut the price has been uniformly 14.75c. delivered. In addition, some sales have been made at distant freight rate destinations at 14.875c. and 14.95c. and some metal for delivery close to the refineries was sold at less than the equivalent of 14.75c. Connecticut.

Lead Market Active; Prices Firm

Volume of lead business during the last week has been the largest reported since early last March. London reports a small net advance for the period under review, spot lead advancing 5s. per long ton today to offset a corresponding decline reported yesterday. Lead available at 5.975c. per pound in East St. Louis late in the last *Engineering and Mining Journal* week was quickly absorbed, and this week the only variations from the regular 6c. quotation in that market were on the higher side. Price in New York remains at 6.20c. per pound, the level of the American Smelting & Refining Company's contract price. Of the past week's business a very considerable proportion has been for August delivery, and in quite a few instances large consumers have entered the market for good-sized tonnages, on which immediate delivery was specified. Battery manufacturers have been among those indulging in this practice—a condition which may be taken to indicate that automobile production is being maintained at a higher level than the battery people had expected. Corroding lead has been in good demand likewise, although requirements for early delivery have not been pressing. Predictions of an early advance in the contract price of the American Smelting & Refining Company are heard in some quarters, whereas other authorities feel that any further change in the New York price level will be made with hesitancy. At least one large producer is asking 6.05c. for his chemical lead in East St. Louis, and not offering metal freely at that price.

Fair Week in Zinc

Tonnage of zinc sold during the week was substantially higher than in the two preceding weeks and was close to the average. Except for some sales made today at 6.30c., the prevailing price in St. Louis was 6.25c. With concentrate in Joplin selling at $40 per ton, smelters can make some profit with slab zinc at 6.25c., but they would like to realize a little more. Galvanizers are reluctant buyers at present levels, but with the strong attitude taken by producers they are compelled to meet the price to supply urgent needs. High-Grade zinc is nominal at 7.75c. per pound for small spot lots in New York.

Tin Active at Lower Prices

As a result of forced sales in London and the Far East, the price of tin in New York experienced a slight downward reaction late in the past *Engineering and Mining Journal* week. Consumer buying has been evident throughout the week, however, and the decline in price has not served to diminish the interest of consumers to any appreciable extent. Tendency to buy somewhat further in advance has been a feature of consumer buying, although this has not been done at a sacrifice of the demand for spot metal. Some 99 per cent tin has been in the market during the last few days and was sold at a discount of ¾c. to ⅞c. per pound under the prevailing price for Straits.

Silver Steady, With No Marked Change in Price

Conditions remain much the same as during the previous week. Price fluctuations have been negligible and the silver market appears steady at the present level.

Mexican Dollars (old Mexican pesos): Aug. 16th and 17th, 44⅝c.; 18th and 20th, 44½c.; 21st, 44⅜c.; 22d, 44½c.

Foreign Exchange

Foreign exchanges have been steady during the week. Sterling hardened for two days, but reverted to 4.84 7/8c. Closing cable quotations for other exchanges on Tuesday, Aug. 21, were as follows: francs, 3.90 11/16c.; lire, 5.23 5/16c.; and marks, 23.825c. Canadian dollars, which heretofore have been at a slight discount, are now quoted at 1/32 per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York; Chinese brands, for all positions 10⅛@10⅜c. Cookson's "C" grade, spot, 15⅜c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

CADMIUM—Per lb., New York: 70@75c., according to quantity.

IRIDIUM—Per oz., $280@$300 for 98@99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM—Per oz., $42@$47. Small lots bring up to $50. Market very dull.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $74@$74.50 bid, $75.50@$76.50 asked. Nominal.

QUICKSILVER—Per 76-lb. flask, $125. Small lots command a slight premium. Market more active and stronger at higher price levels. San Francisco wires $127.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Aug. 4.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn; 35@38c. Caucasian, washed, 53@55 per cent, 38@40c. Chemical grades unchanged from quotations in the Aug. 4 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.; Wolframite, $10.75@$11, Western scheelite, $10.75@$11.

Chrome, Iron, Tantalum, and Titanium ores are unchanged from quotations in the Aug. 4 issue.

Producers Will Again Restrict Output

Joplin, Mo., Aug. 18, 1928

Blende

	Per Ton
High	$42.35
Premium blende, basis 60 per cent zinc	$40.00@$41.00
Prime Western, basis 60 per cent zinc	40.00
Slimes and fines, 60 per cent zinc	37.00@ 39.00
Average settling price, all zinc	40.27

Galena

High	$82.20
Basis 80 per cent lead	80.00
Average settling price, all lead	81.28

Shipments for the week: Blende, 10,504 tons; lead, 1,598 tons.

At a meeting of zinc-ore producers held last night the production of zinc ore in excess of smelter needs was thoroughly discussed. Several producers announced that they believed that the output was approximately 1,000 tons per week too large, and that their purpose is to restrict production. What method to be adopted was not announced. The plan proposed—the institution of a five-day week—met with the approval of less than half of the production represented. Some mines are now operating on that plan. Others may volunteer to do the same. The need of a restricted output, to prevent the accumulation of an unwieldy reserve stock is acknowledged by all.

Platteville, Wis., Aug. 25, 1928.

Zinc Blende	Per Ton
Blende, basis 60 per cent	$42.75
Lead Ore	
Lead, basis 80 per cent	$80.00

Shipments for the week: Blende, 795 tons; lead, 120 tons. Shipments for the year: Blende, 23,524 tons; lead, 1,405 tons. Shipments for the week to separating plants, 1,352 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Aug. 4 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Market firm and active.

CALCIUM MOLYBDATE or MOLYTE—Per lb. of contained Mo, 95c. delivered.

Antimony Oxide, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Aug. 4 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105 quoted for last half, 1928. Spiegeleisen, 19@21 per cent, $33 f.o.b. furnace.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.20@$1.25. One producer quotes $1.20 on both large and small quantities.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 96@98c. f.o.b. works.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrovanadium, Monel Metal, Nickel Silver and Yellow (Muntz) Metal are unchanged from prices in the Aug. 4 issue.

Rolled Metals

Copper, Lead, and Zinc Sheets are unchanged from prices in the Aug. 4 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Aug. 4.

Iron, Steel, and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $17; basic, $15.75@$16; No. 2 foundry, $16.50@$17.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33; plates, structural shapes, and soft steel bars, per pound, 1.85@1.90c.

Coke—Per gross ton, Connellsville furnace, contract, $2.75@$3; spot, $2.50@$2.75. Connellsville foundry, contract, $3.50@$4.85; spot, $4@$4.85. By-product coke, Ohio and Keptucky, $7; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended August 18, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	67⅛	64⅛	67	Jl.14, Au. 20 Q	1.00
Ariz. Com'l	Boston	4⅛	4	4	Jl. 16, Jl. 31 SA	0.25
Cal. & Ariz.	New York	99	93½	97	Je. 8, Je. 25 Q	1.50
Calumet & Hecla	Boston	23⅛	23	23½	Au. 31, Se. 15 Q	0.50
Cerro de Pasco	New York	78½	75½	77⅛	Jl.12, Au. 1 Q	1.25
Chile Copper	New York	44⅞	42⅜	44½	Se.15 Se.29 Q	0.62½
Con. Coppermines	N. Y. Curb	11½	10⅜	11⅜		
Copper Range	Boston	18	17	18	Mr. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*45	*35	*36		
East Butte	Boston	2⅛	2⅛	2⅛	Dec., 1919	0.50
Granby Consol	New York	54	52½	53⅜	Jl.13, Au.1 Q	1.00
Greene Cananea	New York	102½	97⅛	101½	Se. 14, Oc.1 Q	1.00
Howe Sound	New York	58⅜	55⅛	57⅜	Je.30, Jl. 16, Q	1.00
Inspiration Consol	New York	21½	20	21	Apr. 1927 Q	0.25
Isle Royale	Boston	19½	18½	18⅝	Au.31, Se.15 SAX	0.75
Kennecott	New York	96⅜	93⅛	96⅛	Au.31, Oc. 1 Q	1.50
Magma Copper	New York	51½	48⅜	50½	Jl.29, Jl.16 Q	0.75
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Miami Copper	New York	22⅛	20⅜	22	Au.1, Au.15, Q	0.37½
Mohawk	Boston	56½	54	54	Jl. 31, Se. 1 Q	1.00
Montana-Idaho	Spokane	*17⅜	*16	*16		
Mother Lode Coal	New York	2⅛	2⅛	2⅛	Je.8, Je. 30, SA	0.15
Nevada Consol	New York	24⅛	22⅞	24⅛	Je.15, Je.30 Q	0.375
New Cornelia	Boston	27½	27	27	Au.3, Au. 20 Q	0.50
Noranda	N. Y. Curb	57⅛	47⅛	53⅛		
North Butte	Boston	4	3½	3½	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*73	*70	*70	Sept., 1926	0.03
Old Dominion	Boston	14⅛	14	14	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	135	135	135	Je.25, Jl.22 Q	2.00
Quincy	Boston	39½	32⅛	38½	March, 1920	1.00
St. Mary's Min. Ld	Boston	28	27	28	Ap.1928 A	2.00
Seneca Copper	New York	2⅛	2⅛	2⅛		
Shattuck-Denn	N. Y. Curb	18½	17⅛	17⅛		
Tenn. C. & C.	New York	15½	14⅛	14⅛	Au., 31 Se.15,Q	0.25
United Verde Ex	N. Y. Curb	15	14⅛	14⅛	July 6, Q	0.50
Utah Copper	New York	170	165	170	Je.15, Je.30 Q	1.50
Utah Metal & T	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	1.20	1.17½	1.20		
NICKEL-COPPER						
Internat. Nickel	New York	103⅜	95½	101½	Je.14, Je.30 Q	0.50
Internat. Nickel pfd	New York	123	120	123	Jl.12, Au.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*5	*2⅜	*5	June, 1927	0.005
National Lead	New York	120½	119⅛	120½	Se.14, Se.29 Q	1.25
National Lead, pfd. A	New York			144½	Au.31, Se.15 Q	1.75
National Lead, pfd. B	New York			122	Oc. 19, No.1 Q	1.50
St. Joseph Lead	New York	43⅜	39⅛	42⅜	Je.9, Je.20, QX	0.75
ZINC						
Am. Z. L. & S.	New York	28⅛	26½	27⅜	May, 1917	1.00
Am. Z. L. & S. pfd	New York	86⅛	84⅛	86	Nov., 1920	1.50
Butte C. & Z.	New York	7½	7	7	De., 1926	0.50
Butte & Superior	New York	9⅛	9⅛	9⅛	Je.15,Je.30 Q	0.50
Callahan Zn-Ld	New York	3⅛	2⅞	3	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	13⅛	12⅞	12⅞	Je.25, Jl.1 Q	0.25
Eagle-Picher	Cincinnati	18⅛	17⅛	18	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati			100	July 15 Q	1.50
New Jersey Zn	N. Y. Curb	222	216	216⅛	Jl. 20, Au. 10 X	2.00
Treadwell-Yukon	Toronto	15.75	15.50	15.50		
United Zinc	N. Y. Curb			*70		
Yellow Pine	Los Angeles	*25	*25	*25	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	4	3⅞	3⅞		
Ankerite	Toronto	*25	*25	*25		
Barry-Hollinger	Toronto	*38	*35	*37½		
Central Manitoba	Toronto	*90⅛	*83	*88		
Cresson Consol. G	N. Y. Curb	*95	*95	*95	Je.30, Jl.10 Q	0.10
Dome Mines	New York	8⅛	8	8	Je.30, Jl.20 Q	0.25
Golden Cycle	Colo.Springs	†1.72	†.69		My. 31, Je.10 Q	0.04
Gold Hill	Toronto	10⅛	7⅞	10		
Hollinger Consol	Toronto	11.00	9.25	10.60	Au. 22, Se. 15 M	0.10
Homestake Mining	New York	73	73	73	Au.20, Au.25 M	0.50
Kirkland Lake	Toronto	1.48	1.40	1.48		
Lake Shore	Toronto	20.40	21.00	20.20	Se.1, Se.15, QX	0.20
McIntyre Porcupine	New York	21⅛	21⅛	21⅛	Au.1, Se.1 Q	0.25
Portland	Colo.Springs	†*21	†*19⅛		Ap., 1927	0.02
Rand Mines	New York			39⅛	Au.21-28 Am.Sh.	1.52
Sylvanite	Toronto	2.43	2.25	2.35		
Teck-Hughes	Toronto	9.40	8.80	9.33	Jl. 17, Au. 1 SAX	0.15
Tom Reed	Los Angeles	*61	*50⅛	*52	Dec., 1926	0.02
Tough-Oakes	Toronto	*28	*21	*27		
Vipond Cons	Toronto	*45⅛	*44	*44⅛	April, 1927	0.03
Wright-Hargreaves	Toronto	3.50	3.20	3.50	Jl.16, Au.1 Q	0.02½
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb			17⅛		
Con. Cortez	N. Y. Curb			*25		
Dolores Esperanza	N. Y. Curb	1⅛	1⅛	1⅛	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb			15	Jl.18, Jl.28 Q	0.50
Premier Gold	N. Y. Curb	2⅛	2 1/16	2 1/16	Je.14, Jl.3 Q	0.06
Tonopah Belmont	N. Y. Curb			1	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	*13	*11	*11	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	4⅛	4⅛	4⅛	Mar.31,Ap.21 SA	0.07½
West End Consol	N. Y. Curb			*5	Mar., 1923	0.05
Yukon Gold	Boston Curb	*66	*66	*66	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	*88	*81	*81	May, 1920	0.03
Castle-Trethewey	Toronto	*48	*41	*48		
Coniagas	Toronto	4.35	4.10	4.10	May, 1924	0.12½
Keeley	Toronto	*49⅛	*42	*46	Mr.1, Mr.15 SA	0.04
Lorrain Trout Lake	Toronto			*50	July, 1925	0.05
Mining Corp. Can	Toronto	3.30	3.03	3.26	My.20, Je.13 SA	0.125
Nipissing	N. Y. Curb	3⅛	3	3⅛	Je.30, Jl.20Q	0.075

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3	2⅞	2⅞	Ap., 1927	0.12½
Bingham Mines	Boston	47	43⅜	46	Jl.31, Au.4 Q	1.00
Bunker Hill & Sullivan	N. Y. Curb	125	125	125	Jl.31, Au.4 MX	0.75
Cardiff M. & M.	Salt Lake	*54	*53	*53	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	3.50	3.20	3.50	Ja.10, Fe.1 K	0.10
Consti'n Mng.&Mill'g.	Spokane	*22	*20	*20		
Erupcion	Boston Curb			*20	Dec. 13, Jan. 3,	0.07½
Eureka Lily	Salt Lake	1.85	1.72½	1.85		
Federal M. & S.	New York			125	Je., 1927	10.00
Federal M. & S. pfd	New York			98	Au. 24, Se. 15 Q	1.75
Hecla Mining	N. Y. Curb	15⅜	14⅛	15⅜	Au.15, Se. 1 Q	0.15
Highland-Surprise	Spokane	*12	*10	*11		
Iron King Mining	Salt Lake	*85	*84	*84		
Keystone Mining	Salt Lake	*31	*31	*31	Fe., 1926	0.07½
Lucky Jim	Spokane	*29	*28	*28		
Lucky Tiger-Com	Kansas City	†7.40	†7.15		Au.10,Au.20 M	0.05
Mammoth Mining	Salt Lake	1.50	1.35	1.40	De., 1926	0. 25
North Lily	Salt Lake	7.60	7.30	7 30		
Park Utah	New York	10⅜	9	10	Je.15, Jl.2 Q	0.20
Plutus Mining	Salt Lake	1.40	1.10	1.10	Ap.10, Ap.16 Q	0.10
Rico-Argentine	Salt Lake	*48	*47	*48	June 15 Q	0.03
Silver King Coal	Salt Lake	13.25	12.75	13.25	Je.20, Jl.2 Q	0.25
Silversmith	Spokane	*10⅛	*9	*10	Oct., 1926 Q	0.02
Strattons Mines	Spokane	1.13	*96	1.13		
Sunshine M. Co.	Spokane	1.46	1.30	1.41	June 20, K	0.02
Tamarack-Custer	Spokane	*45⅛	*43	*43	Sept., 1924	0.25
Tintic Standard	Salt Lake	14.00	13.62½	14.00	Je.18, Je.30 QX	0.30
Utah-Apex	Boston	3⅛	3⅛	3⅛	Jl.14, Au.1 K	0.25
IRON						
Bethlehem Steel	New York	62⅛	56⅛	61½	Jl., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	125	106	120	Jl.14, Jl.25. Q	1.00
Colorado F & I, pfd	New York	62⅛	58	61⅛	Au.10, Au.25 Q	2.00
Gt. North'n Iron Ore	New York	21⅛	20⅛	21½	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	66½	58	65	Au. 15, Se.1 Q	0.62½
Republic I. & S.	New York	67⅛	61½	66⅛	Au. 14, Se. 1 Q	1.00
Republic I. & S. pfd	New York	107	105	106⅛	Se. 15, Oc. 1 Q	1.75
Sloss-Sheffield S. & I	New York	111	110	110	Je.9, Je.20 Q	1.50
Sloss-Snef. S.&I. pfd	New York	105	105	105	Je. 20, Jl. 2 Q	1.75
U. S. Steel	New York	149⅛	142	149	Au.30, Se.29 Q	1.75
U. S. Steel, pfd	New York	140⅜	140	140⅛	Au. 6, Au. 30 Q	1.75
Virginia I. C. & C.	New York	27	27	27	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York	50	50	50	Je. 16, Jl. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	24⅛	24⅛	24⅛	Ju.16, Ju.26 K	0.97
So. Am. G. & P.	N. Y. Curb	3⅛	3⅛	3⅛		
Alum. Co. of Amer.	N. Y. Curb	140	136	137½		
Alum. Co. of Amer. pf.	N. Y. Curb	108	107⅛	108	Je. 15, Jl. 1 Q	1.50
Vanadium Corp.	New York	75½	70	73½	Au. 1, Au. 15 Q	0.75
Patino M. & E.	New York	35	31⅛	33⅛	April, 1928	4s.
ASBESTOS						
Asbestos Corp.	Montreal	27⅛	27	27	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	90	89	89	Jl. 30, Jl. 16 Q	1.75
SULPHUR						
Freeport Texas	New York	63⅛	60⅛	62⅛	Jl.14, Au.1 QX	1.75
Texas Gulf	New York	69⅛	67⅛	69	Se. 1, Se 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	48⅛	47⅛	47⅛	Au. 21, Se 1 Q	0.75
Amer. Metal, pfd. 6%	New York	109	109	109	Au.15, Se.1 Q	1.50
Amer. Met. pfd 7%	New York			125	My.15, Je.1	1.75
Amer. Sm. & Ref	New York	215½	196⅛	214½	Jl 13, Au.1 Q	2.00
Amer. Sm. & Ref. pfd	New York	134½	134⅛	134⅛	Au. 3, Se. 1 Q	1.75
Consol. M. & S.	Montreal	245	239½	244½	Je.30, Jl.16 SAX	6.25
Newmont Mining	N. Y. Curb	160⅞	152⅛	158⅛	Je.30, Jl.16 Q	1.00
U. S. Sm. R. & M.	New York	48⅛	46	48⅛	Jl. 5, Jl. 14 Q	0.87½
U.S. Sm. R.&M. pfd	New York			53⅛	Jl. 5, Jl 14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED August 7, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	35/6	35/—	35/—			
Alaska Treadwell ($25)	120/6	120/—	120/—	Nov., 1926	4 (d)	
Aramayo Mines (25 frs.)	76/—	65/—	65/—	May, 1928	5 p.c. (†)	
Burma Corpn. (10 rupees)	14/—	13/9	13/10½	Aug., 1928	6 annas*	
Bwana M'Kubwa (5s)	7/6	6/6	7/4½			
Camp Bird (2s)	3/10½	3/6	3/9	April, 1928	16⅛ p.c.	
El Oro (£1)	4/1½	3/10½	4/1½	Nov., 1924	2½ p.c.*	
Frontino & Bolivia (£1)	11/10½	10/6	11/3	July 1928	3½ p.c.	
Mexican Corpn. (£1)	9/—	8/3	8/9			
Mexico Mines of El Oro (£1)	25/—	16/3	25/—	Dec., 1926	3½ p.c.*	
Mond Nickel	78/1½	73/6	75/—	Aug., 1928	20 p.c.	
N'Changa Copper Mining	21/3	19/6	20/3			
Oroville Dredging (£1)	3/9	3/6	3/9	Dec., 1923	3½ p.c.	
Rhodesian Congo Border (£1)	35/7½	33/9	35/—			
St. John del Rey (£1)	11/6	11/1½	11/6	April, 1928	7½ p.c.	
San Francisco Mines (10s)	27/3	26/7½	27/	July 1928	12½ p.c.	
Santa Gertrudis (£1)	14/4½	14/—	14/—	July 1928	7½ p.c.	
Selukwe (2s. 6d.)	10/6	10/3	10/6	April, 1917	6¼ p.c.	
S. Amer. Copper (2s.)	2/3	2/—	2/1½	Nov., 1917	75p.c.	
Tanganyika (£1)	56/6	53/9½	56/3	July 1928	5p.c.	
Union Miniere de Haut-Katanga (Brussels)	10,500	9,800	10,500	July, 1928	182.60 (‡)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. §U. S. Dollars.

Current Prices of Mining Supplies

Rise and Fall of the Market

COST of materials entering into construction of mines has been increasing gradually since the first of the year. Mine timbers, particularly, began the upward movement in May of this year. Few price changes occurred during the last month in the minor supplies. Galvanized steel sheets rose 20c. per 100 lb., f.o.b., Pittsburgh; linseed oil is down 0.5c. per lb. at Chicago.

SHEETS—Quotations are per 100 lb. in various cities delivered from warehouse, also the base price at mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Galvanized No. 24	$3.60@$3.75	$5.10	$4.65	$5.40	$4.95

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh, Chicago and Birmingham in carloads:

	Pittsburgh	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00
Standard open hearth rails	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for large mill lots, together with the warehouse prices at other places named:

	Pittsburgh	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅞-in. and larger	$2.80	$3.55	$3.65	$3.85	$3.00
Track bolts	3.80	4.55	4.65	5.35	3.90
Standard section angle bars, splice bars or fish plates	2.75	3.40	4.25	4.25	3.00

STRUCTURAL MATERIAL—Following are base prices per 100 lb. in large mill lots, f.o.b. mill, Pittsburgh and Birmingham. At other cities listed, quotations are per 100 lb., delivered from warehouse:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.85	$2.05	$3.30*	$3.75	$3.25	$3.10	$3.25
Channel, 3 to 15 in.	1.85	2.05	3.30*	3.75	3.25	3.10	3.25
Angles, 3 to 6 in., ¼-in. thick	1.85	2.05	3.30*	3.75	3.25	3.10	3.25
Tees, 3 in. and larger	1.85	2.05	3.30*	3.75	3.25	3.10	3.25
Plates ¼-in. thick	1.85	2.05	3.30*	3.75	3.25	3.10	3.25

*250 to 3,999 lb.

WIRE ROPE—Discounts from list price, f.o.b. New York and territory east of Missouri River on regular grades of bright and galvanized, are as follows:

Cast steel round strand rope	20 %
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5 %
Plow steel round strand rope	35 %
Special steel round strand rope	30 %
Gavanized iron rigging and guy rope (add to list)	12½%

MANILA ROPE—Per lb., ¾-in. and larger, delivered in 1,200-ft. coils:

Atlanta	$0.25	New Orleans	$0.23½
New York	.24	Seattle	.21½
Chicago	.21	San Francisco	.21½

DRILL ROD (from list at warehouse)

New York	Cleveland	Chicago
60%	55%	50%

WROUGHT IRON AND STEEL PIPE—The following discounts from list, are for large mill lots at Pittsburgh mill:

	Steel			Iron		
	Inches	Black	Galv.	Inches	Black	Galv.
Butt Weld	⅛ to 3	62	50½	⅛ to 1¼	30	13
Lap Weld	2½ to 6	59	47½	3 to 6	28	13

WROUGHT-STEEL PIPE—From warehouses at the places named the following discounts from list hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
2½ to 6 in., lap welded	45%	51%	46%

CAST-IRON PIPE—The following are prices on bell and spigot pipe, Class B and heavier, f.o.b. per net ton, for large mill lots.

	Birmingham	New York	Chicago	St. Louis	San Francisco
6 in. and over	$34.00	$39.60	$42.20@43.29	$39.60	$44.00

MACHINE BOLTS—Square heads and nuts, up to 1x30-in., full packages, discount 50% from latest list, April 1, 1927, at warehouses in New York and vicinity

NUTS—Hot pressed or cold punched, square or hexagonal, blank or tapped, up to 1-in., inclusive, full packages, carry a discount of 55% from latest list, April 1, 1927, on immediate deliveries from warehouse stocks in New York and vicinity.

HOLLOW TILE—Price per block to contractors, in lots of 2000 pieces or over:

	New-York	Chicago	Philadelphia	St. Louis	San Francisco‡	Perth Amboy N. J., Factory
4x12x12	$0.0973	$0.076	$0.11	$0.078	0.108	
6x12x12	.1459	.104	.145	.105	.156	$0.252*
8x12x12	.1824	.142	.22	.145	.255	.312†

*10x12x12; †12x12x12.

LUMBER—Price per thousand feet, board measure, for timbers:

San Francisco—Rough Douglas fir, No. 1 common, at yards:

	10-16-18 and 20 Ft.	22 and 24 Ft.
3x3 and 4	$28.00	$29.00
3x6 and 8	28.00	29.00
3x10-6 and 12	28.00	29.00

New York—Prices are for long-leaf, yellow pine timbers (rough) at wholesale, in quantities of 35,000 ft. or more, within lighterage limits:

	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$41.00@43.00	$42.00@44.00
3x10 to 10x10	48.00@50.00	49.00@51.00
3x12 to 12x12	55.00@57.00	56.00@58.00

Chicago—Prices in carloads, f.o.b., for long-leaf, yellow pine timbers, No. 1 and Douglas fir, No. 1:

	Up to 20 Ft., Pine	Up to 32 Ft., Fir
3x4 to 8x8	$37.50	$41.50
3x10 to 10x10	46.50	41.50
3x12 to 12x12	56.50	41.50

Other Cities—Price for rough timbers delivered:

	8x8-In. x 20 Ft. and Under				3x12 to 12x12-In. 20 Ft. and Under	
	Pine	Fir*	Hemlock	Spruce	Pine	Fir*
Boston	$48.00	$47.00	$47.50	$50.00	$56.25	$50.00
Cincinnati	36.00	49.00	47.00	47.00	40.00	54.50
Denver	.....	57.00	.....	.....	.....	45.00
Minneapolis	53.00	48.25	36.25	.....	53@55	48.25
Kansas City, Mo.	40.50	38.75	.....	.....	53.50	48.75
Philadelphia	55.00	37.00	42.00	43.00	65.00	50.50

* Douglas Fir.

NAILS—The following quotations are per 100 lb. keg from warehouse:

	Pittsburgh Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.55	$3.10	$3.60	$4.00	$2.75	$4.95
Cut	2.80	.....	5.00	5.00	.....	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without charge for bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.25@$2.35	$2.25@$2.35	$2.35
Chicago, f.o.b.	2.05	2.05	2.05
Cleveland, f.o.b.	2.24	2.24	2.24

LIME—Delivered: New York quotes bbl. 280 lb. net; Chicago, 180 lb.:

	Hydrated, per Ton		Lump, per Barrel	
	Finishing	Common	Finishing	Common
New York	$21.00@22.00	$14.00@15.00	$4.00@4.10	$3.15@3.25
Chicago	20.00	18.00	.....	1.50

LINSEED OIL—These prices are per pound:

	New York	Chicago	Minneapolis
Raw in barrels (1 to 4 bbl. lots)	$0.105	$0.103	$0.112

WHITE AND RED LEAD—Per 100-lb. keg base price, f.o.b. New York.

	Dry	In Oil
Red	$13.25	$14.75
White	13.25	13.25

HOSE—Quotations at New York warehouses:

Fire Protection — 50-Ft. Lengths $0.60 per ft.

Underwriters' 2½-in. coupled, single jacket (net)

Air—Best Grade

¾-in., per ft. 3 ply $0.30 — 4 ply $0.36

Steam—Discounts from List

First grade 40% — Second grade 45% — Third grade 50–10%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting. Discounts from list are as follows:

Best grade 50% — Second grade 60%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply, at New York warehouses:

Grade	Discount from list
Medium	30–10%
Heavy	25–5%

PACKING—Prices per pound at New York warehouses:

Rubber and duck for low-pressure steam, ¼ in.	$0.90
Rubber sheet	.45
Rubber sheet wire insertion	.75

EXPLOSIVES—Prices per pound for dynamite delivered in small lots:

	Gelatin 40%	Gelatin 60%
New York (special gelatin in case lots)	$0.26	$0.2825
Minneapolis	.1967	.2173
Denver (f.o.b.)	.1925	.215
Seattle	.16	.185
Cincinnati	.22	.245
San Francisco	.1625	.1925

FLOTATION OIL—Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.33

CHEMICALS—Prices for round lots in New York market, per lb.:

Zinc dust, 550 lb. casks	$0.08½@.09
Litharge, casks	.08½
Sodium cyanide, 220 lb. single case lots	.18@.22
Calcium carbide, in drums	.05@.06